METALINGUISTIC AWARENESS

IN

LITERATE AND ILLITERATE CHILDREN AND ADULTS:

A PSYCHOLINGUISTIC STUDY

by

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I declare that this thesis has been composed exclusively by myself and that the work involved is entirely my own.

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ABSTRACT

One of the major goals of psycholinguistic research is to be able to account for those mental operations which enable native speakers not only to perform the basic linguistic capacities such as comprehending and producing an illimited number of utterances, but also to exercise such metalinguistic abilities as to judge utterances, segment words, identify sounds and detect ambiguities.

The primary concern of this thesis was to elucidate the processes underlying certain aspects of metalinguistic awareness and to trace their relationship to advances in maturation and acquisition of literacy. The guiding principle has been to determine how much of what has been considered normal cognitive development is in fact an age-bound developmental phenomenon, or to what extent it reflects the result of experiences associated with the degree and extent of literacy. The need for this is apparent on examining previous research which, as we demonstrate, has confounded such theoretically important variables as Age, Literacy and peculiarities of the native language.

The aim of the methodology employed here was to deconfound such variables and add more insight as to the nature of metalinguistic abilities. First, by employing literate and illiterate children and adults, the design optimizes the likelihood of tapping a precise relationship between maturation, literacy and metalinguistic awareness. Second, by using native speakers of Arabic, the general design offers the opportunity to add insight from yet another language typologically different from English in which most previous research was conducted. Third, by employing more than one type of linguistic measure for the same population, the design also hopes to answer one empirical question, namely, whether metalinguistic awareness can be conceptualised as either multidimensional or unitary in nature.

The Subjects who participated in the study were 120 Moroccan Arabic speaking literate and illiterate children and adults drawn from a relatively homogeneous socio-economic background. A total of seven experiments -- some with subtasks -- were used.

Six chapters make up the study. In Chapter 1 we have tried to provide an introduction to the theoretical issues which we think are of central importance to the topic under investigation. Because our approach is essentially psycholinguistic, Chapter 2 describes and discusses the methodology employed to gather the necessary data for the study. It is also concerned with the procedures used to evaluate these data.

Chapters 3, 4, and 5 form the main bulk of the research. Using various experiments, they examine the extent to which Ss deploy their metalinguistic knowledge in the process of attending to and manipulating the following linguistic units: (i) words (Chapter 3); (ii) syllables (Chapter 4); (iii) segments (Chapter 5). Typically, each one of these chapters considers various hypotheses and research questions which concern the specific linguistic unit.

Finally, Chapter 6 draws general conclusions from the general study and addresses some implications for linguistic theory, psycholinguistic research and, although not extensively, education research.

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TABLE OF CONTENTS

Page

CHAPTER ONE

I Introduction

Most psycholinguistic research into adult language behaviour has been concerned with how speech is comprehended and, although to a lesser degree, with how speech is produced. Similarly, child language research has emphasised the child's expressive as well as receptive linguistic system. The study of first language development consisted mainly of syntactic development with some lexical meaning acquisition [1]. In other words, both lines of research have been interested in the native speaker's actions.

Recently, however, under the umbrella term of metalinguistic awareness, or sometimes metalinguistic knowledge, a new domain of research has emerged which has focused on the speaker's ability to reflect upon his linguistic system - the speaker's reactions, as it were. The present study considers that this area of inquiry, which was once viewed as peripheral, constitutes an equally important dimension of the task of knowing one's language. Specifically, the aim of the study is to explore the relationship that may exist between metalinguistic abilities, maturation and literacy. The rationale for this will be made clear presently. For the present, because metalinguistic awareness is a new domain of research, it is important to define terms and establish as precisely as possible the area it is intended to cover and the aims it intends to achieve. This is essentially what we set out to do in the following section.

II Characterizing 'Metalinguistic Awareness'

One of the attributes of human language-users which is often cited, but rarely analysed enough for us to assess its importance, is reflectiveness. It concerns the ability that native speakers have to use language to talk about language. In more general terms, the ability to reflect upon language not simply as a mode of communication, but as a system.

According to Jakobson (1958), one of the functions of language beside the emotive (concerning the addresser), the conative (concerning the addressee), the phatic (concerning the contact), the referential (concerning the context), the poetic (concerning the message) is the metalinguistic function which concerns the code itself. The use of language to talk about language has long been the domain of logic and the philosophy of language. In Jakobson's (1958) words

> "metalinguistic operations are far from being confirmed to the sphere of science, they prove to be an integral part of our customary linguistic activities" (p 80).

He goes on,

> "the interpretation of one linguistic sign through other, in some respect homogeneous, signs of the language, is a metalinguistic operation" (p 81).

For him, functions of metalinguistic elements play an essential role in the acquisition of language.

> "Recourse to metalanguage is necessary for both acquisition and for its normal functioning. The aphasic defect in the capacity of naming is properly a loss of metalanguage. One of the functions of language, then, is its metalinguistic function." (op. cit.)

The same claim is made by Lyons (1981) who observes that

> "the metalinguistic use of language is not just one language game among many. It is essential to the acquisition of language in childhood and all-pervasive in its normal use thereafter" (p 293).

To be able to employ the code to refer to the code itself or aspects of it, one must undoubtedly attend to the code, look at it and not through it, as it were. This is attained when language becomes opaque enough for us to be able to detach ourselves so as to contemplate it as an object of analysis, in its own right. To be able to achieve this, native speakers must become aware of language as an object. In this sense, the term 'metalinguistic' goes beyond the linguistic meaning to take on a cognitive one.

In recent research, "metalinguistic awareness" is one of those terms which many a reference is made to, but about which there is very litle agreement. Investigators reveal the general confusion by characterizing metalinguistic awareness according to their research aims, and by proliferating of terminology in the literature. The use of terms as diverse as 'metalinguistic awareness', 'metalinguistic knowledge', 'metalinguistic abilities', 'linguistic consciousness', or simply 'linguistic intuitions' to characterize the same phenomenon is typical of the literature. Three examples will suffice to demonstrate this.

The first one is from Hakes' (1980) The Development of Metalinguistic Awareness in Children in which the author uses 'metalinguistic awareness', 'metalinguistic knowledge', 'metalinguistic activities', 'metalinguistic performance' and 'meta-abilities' all of which refer to more or less the same concept. That the title proposed originally by Hakes for the same monograph was The Emergence of Intuitions in Children (see Clark, 1978), is hardly surprising.

The second example comes from Ferguson and Slobin's (1973) Studies of Child Language Development where the concept is also referred to as "linguistic consciousness" (p 138). The third and final example is more interesting in the sense that it highlights the terminological issue alluded to above. In their Psycholinguistics: An Introduction (1978), Foss and Hakes write

> "we have seen earlier that adults are able to do many things with language above and beyond being able to produce and understand it. Many additional abilities involve, in one way or another, being able to reflect upon language. These are the sorts of abilities that linguists refer to as linguistic intuitions (emphasis not in text); we will describe them here as metalinguistic abilities" (p 302) (emphasis not in text).

In very general terms metalinguistic awareness may be characterized as the ability to reflect upon the structure and functions of language, treating language itself as an object of thought rather than simply using it to comprehend and produce sentences. Apparently, this ability is achieved when language loses its transparency as we cease to see meaning through it. According to Cazden (1972, 1975) metalinguistic performances involve treating language as 'opaque', something to be focused on.

In information processing terms (La Berge and Samuels, 1974; Shiffrin and Schneider, 1977), metalinguistic knowledge can be characterized as 'controlled' (analysed) as opposed to 'automatic' (unanalysed) knowledge. The prototypical controlled cognitive process is one that requires attention (awareness?): It is deliberate and intentional. On the other hand, the prototypical automatic process requires no such awareness [2]. It is an automatic consequence of other processing.

One consequence of focusing one's attention and reflecting deliberately upon the properties of one aspect of language is that it tends to divorce language from its context (Olson, 1977; Hakes, 1982). Olson (1977) distinguishes between utterance (contextualized) and text (decontextualized). For him, oral language is contextualized; written language is decontextualized (see also Donaldson (1978) who uses embedded/disembedded to refer to the same idea).

Activities that are indicative of metalinguistic ability can be described as consisting of specific bits of knowledge about phonology, word form and sentence form. In the research literature, four broad categories emerge: (1) phonological awareness, (2) word awareness, (3) form awareness and (4) pragmatic awareness. Each level subsumes a range of very specific abilities. Thus, phonological and word awareness refer to the awareness of the subunits of spoken language (eg segmentation of speech into segments, syllables, word units; appreciation of puns, rhyming) (Berthoud-Papandropoulou, 1980; Barton and Hamilton, 1982; Content, 1984). Form awareness refers to the ability to provide intuitive judgements of grammaticality and acceptability of utterances, (de Villiers and de Villiers, 1972; Gleitman, Gleitman and Shipley, 1972; Carr, 1979) detection of structural and lexical ambiguities, appreciation of linguistic jokes and riddles (Fowles and Glanz, 1977; Hirsh-Pasek, Gleitman and Gleitman, 1978). Pragmatic awareness refers to the relationships that obtain among a set of propositions which includes the literal and intended meanings of its members (see Figure 1.1 below).

With due respect to the complexities and subtleties of the issue, the position taken here is that metalinguistic awareness is a construct which refers to what a person is aware [3] of about his/her language activities and what he/she is able to do about them. The specific meaning will become clearer by reference to the tasks used to assess this phenomenon in literate and illiterate children and adults.

In the present study, we assess the concept of metalinguistic awareness and at the same time challenge certain aspects of recent research. We assume, without arguing for it at this stage (see below), that there exists a connection between metalinguistic awareness and literacy [4]. We hypothesize that decoding written language enhances linguistic awareness. We contend that in literate cultures the concepts of linguistic units which children and adults acquire are mainly a result of literacy. It is unlikely that those linguistic features which are represented in a given script do not become objects of awareness to the native speaker as script-user. We think about words very differently before and after learning how to write them. Furthermore, it is not implausible, we contend, that users of different writing systems will differ in their awareness of the various linguistic units. Being familiar with a particular script and a particular way of transcribing one's language may distort one's phonetic intuitions by making them 'deaf' to certain phonetic realities that are not normally expressed in the script. More specific research questions will be formulated in subsequent sections (see Chapter 2).

Rationales accompanying metalinguistic research have been various. By far the majority of research has been concerned with children and only rarely has it investigated the phenomenon in adults.

Thus, in the opening chapter, the editors of The Child's Conception of Language (1978) set out their discussion by claiming that

> "there is an unmistakable connexion between the criteria of developmental stage and explicitness: the older the child, the greater his facility to reflect upon language" (p 4).

Similarly, Hakes (1982) claims that

> "the kinds of relevant adult (metalinguistic) performances seem relatively clear. For one, adults are able to segment spoken words into their phonological segments as, for example, in counting the number of segments a word contains" (p 187).

As we demonstrate further below, the ability of adults is assumed rather than justified.

Research in this area is proceeding in at least three directions. The first is the role of language awareness during the course of early language acquisition. The second is the relationship between the child's growing awareness of language and his level of cognitive functioning. The third is the role of language awareness in the acquisition of reading skill. Other lines of research such as the assumed role of bilingualism in promoting metalinguistic awareness, and the place of metalinguistic knowledge in linguistic theorizing will also be considered.

A. Language Awareness and Language Acquisition

Evidence from metalinguistic awareness would be very useful in that it can complement the already available evidence from comprehension and production. One approach initiated by Marshall and Morton (1978), for example, is to describe early forms of linguistic awareness in terms of feedback mechanisms which are involved in the acquisition of basic linguistic skills. Marshall and Morton (1978) propose a processing model in which normal language processes (NLP) are monitored by a different apparatus (EMMA - "Even More Mysterious Apparatus") whose function is to find, describe and repair [5]. According to Marshall and Morton, linguistic awareness is not to be considered as a mere epiphenomenon. They argue that 'awareness' corresponds to the operation of an error-detecting mechanism which has access to subparts of the primary linguistic production and comprehension systems. The authors hypothesize that during language acquisition, the comprehension system "teaches" the production system via error description and rule transmission, by calling on an "awareness operator".

In the same vein, Halliday (1975) considers that metalinguistic awareness (which he calls "mathetic function of language") arises to serve a well-defined purpose for the child. According to him,

A child knows what language is because he knows what it does.

Clark (1978) and Clark and Andersen (1979) argue that children monitor what they say from the very early stages of language acquisition on. Evidence comes from the spontaneous repairs that children make to their own utterances as they talk. The fact that children make spontaneous repairs is, Clark and Andersen (1979) argue, "strong evidence that they are aware of language, its forms and functions, throughout the acquisition process." (p 11). They argue further that without the ability to monitor, check, and then repair one's utterances, it is unclear how children go about changing a rudimentary system into a more elaborate one (see also Slobin, 1978). Apparently, the mechanism of monitoring and checking offers just the kind of mechanism that may be needed for the acquisition of such a complex skill as language.

In the literature three developmental stages of language awareness levels have been defined by researchers:

(1) <u>Unconscious Awareness or Automatic use of Language</u>: During this stage, early forms of metalinguistic activity are closely related to a communicative situation and serve to establish an effective communication.

(2) <u>Spontaneous Creative Manipulation of Language</u>: During this

stage, children manipulate language in a spontaneous and creative way. They become increasingly able to abstract language away from the action and the context-bound situation. However, this creative manipulation of linguistic forms is not as yet a manifestation of a reflective usage of language, but a manifestation of the child's mastery of linguistic reality. This is also the stage where verbal play abounds. Verbal play is different from language games, in that the latter is characterised by the presence of rules which make them transmittable from one player to another (ie conscious activity). Verbal play, on the other hand, is spontaneous. It can be seen (and has been seen) as a function to develop mastery over language during acquisition. In verbal play, for instance, rhyme producing is not a conscious activity.

3) Conscious Awareness: During this stage, the child has acquired ability to attend to, focus on and deliberately manipulate units of language. This is the stage with which we are concerned in the present study. A relationship between metalinguistic awareness and cognitive development in general, has been claimed to exist by many researchers. As we demonstrate in the next section, however, the relationship between metalinguistic abilities and general development is not readily apparent and empirical evidence is yet to emerge. Besides discussing this issue, in the next section, we also put forth the hypothesis that literacy, namely, reading and writing, helps enhance this conscious awareness.

B. Metalinguistic Awareness and Cognition

The place of metalinguisitic awareness within a metacognitive approach has been proposed (eg Flavell, 1977, 1978; Van Kleeck, 1982; Hakes, 1980; Papandropoulou and Sinclair, 1974). Metacognition refers to the child's increasing awareness of how he can control his intellectual processes to develop potentially useful strategies in problem solving tasks. It refers to knowledge about cognition and includes sensitivity to the need for a strategy, awareness of one's basic process capacities and available strategies. Flavell (1978) defines metacognition as "knowledge and cognition about cognitive phenomena" (p 213). This is in a way similar to Donaldson's (1978) "reflection on thinking". In the literature, the concept of metacognition has been subdivided into sub-concepts (eg metamemory, meta-attention, metalearning). Metamemory (eg Flavell and Wellman, 1977), for example, refers to knowledge about anything concerned with information storage and retrieval.

The relationship that might be shown to exist between metacognition and metalingusitic operations can be expressed as follows:

Metacognition	metalearning		
	metamemory		
	meta-attention		
	metalanguage	phonological awareness	syllable awareness segment awareness rhyming puns
		word awareness	concept of word word segmentation arbitrariness of words
		form awareness	acceptability judgement grammaticality judgement paraphrasing synonymy abiguity detection definition giving
		pragmatic awareness	awareness of inconsistencies communication failure cohesion/coherence (Halliday and Hasan, 1976) Marostructures (Kintsch and Van Dijk, 1978)

Figure 1.1: Hypothesised relationship between metalinguistic abilities and metacognition.

The relationship between language awareness and other cognitive factors, and hence the relationship to cognitive development in general, is far from being clear as a short review of different positions on this topic reveals (see Karmiloff-Smith, 1985). Very little research has been undertaken to test the hypothesis that the array of diverse metalinguistic abilities are all the reflection of an underlying change in the development of metacognition.

In discussing the results of their empirical study of children's awareness of the syllable in French, De Bellefroid and Ferreiro (1979) specifically relate linguistic awareness to general cognitive development but strong empirical evidence is lacking. They suggest that

> "la capacité, de segmentation du mot ne depend pas d'une habilité spécifique, mais constitute le fruit d'un processus actif de reconstruction lié aux capacités cognitives de l'enfant, ainsi qu'à sa possibilité de "prendre de la distance" par rapport au mot, en en faisant un objet de réflexion" (p 34) [6].

Two studies (Hakes, (1980) and Holden and McGinitie (1973)) tested directly the hypothesis that the emergence of linguistic awareness is the linguistic manifestation of the emergence of concrete operational thought as defined by Piaget. The tasks employed were conservation tasks. Both Hakes' and Holden and McGinities's studies suggest that some aspects of metalinguistic awareness, namely, isolating and manipulating elements of language increase during middle childhood (4-8 years) and, although superficially dissimilar, they correlate with performance on a Piagetian conservation task. If this is so, operational levels may exist with respect to language as well as with respect to cognitive structures. From these findings, the claim can be made that the child who cannot predict or imagine the effects of physical operations upon objects may also lack the ability to manipulate elements of language.

There are, however, problems with these findings. First, if they indicate that there may be some relationship between language awareness and cognitive development, they do not, however, reveal which one causes the other to occur. Second, they are weak on methodological grounds. Holden and McGinitie's conclusions are based on one measure of metalinguistic ability, namely, word awareness (the ability to separate and identify words presented in context). On the other hand, both studies ignored the influence of schooling. The fact that children experience a "boost in metalinguistic sophistication" (Hakes, 1980) between the ages of four and eight is rather suspicious: It is precisely during that span that children (at least American children who served as subjects for both studies) are introduced to reading and writing [7].

The same criticism can be levelled at word association studies which reveal that young children (again mainly from literate cultures) seem to undergo considerable change between the ages of five and nine. Apparently, they begin to associate words in a free association task on a paradigmatic basis as members of the same grammatical class (Nelson, 1977), rather than syntagmatically as belonging to different grammatical classes of contiguous words in the undifferentiated utterance (Brown and Berko, 1960; Entwistle, 1966). These findings are interpreted by many researchers as reflecting a change in the structure of long-term memory from an entirely episodic, situation-bound form to a more abstract, symbolic and categorical semantic memory. It should be noted, however, that the years five to nine are precisely the years when the typical child from a literate culture is exposed to intensive reading instruction. So this shift in word association may not or need not necessarily be an age-related developmental change. In fact, Sharp and Cole (1972) examined the syntagmatic/paradigmatic shift word associations in Kpelle-speaking children in a number of experiments. Children and young adults age 8 - 21 who were literate and nonliterate were examined. It was found that while age was significant, number of years of formal education also had a significant effect on the shift from syntagmatic to paradigmatic responding.

But to return to research in metalinguistic knowledge, the point we made above concerning the role of schooling in general and literacy in particular in the development of metalinguistic awareness is consonant with Donaldson's (1978) suggestion that the child's ability to "reflect upon his thinking" should emerge after the child's entrance into the school system. She goes so far as to argue that the development of language awareness is largely responsible for the more general development of an awareness of "thought processes". Hers is a strong language awareness hypothesis where language awareness is considered to be a fundamental influence on the awareness of thought. Flavell (1978) and Brown and De Loache (1978) also make the proposal that such meta-abilities as metamemory or metalanguage play a fundamental role in the individual's thought processes, but they stop short of indicating whether some of these meta-activities are of more importance than others.

Donaldson (1978) believes that one of these meta-abilities, namely, metalinguistic abilities plays an essentially important role in that it is through reflecting upon language that a child becomes metacognitively able, as it were. For her, thinking about 'thought processes' is mediated through language. Furthermore, she believes that skills such as the ability to reason, ability to think in a non-egocentric way, are evident in the child long before he begins school, but only during the school years do they unfold, as it were.

Concerning metamemory, for example, it seems to me to be an activity which is cultivated by schooling. In this context, it is worth noting that only when a child begins school is he required to memorize, is he taught various ways to remember easily and efficiently and, not a trivial thing to consider, is he pressed by his teachers, peers and parents to explain how he has been able to memorize something especially when pertinent to school work. In other words, it is during the school years that the child must deploy his ability to reflect on the product and the strategies employed in memorizing. Deliberate memorizing starts with entrance into the school system. Furthermore, writing becomes an aid to memory. In this regard, it is worth pointing out that writing was <u>not</u> invented to record speech as is often held to be the case, but simply as an aid to memory (see Goody, 1977; also Stubbs, 1981) [8].

By suggesting that schooling enhances meta-abilities, Donaldson extends Vygotsky's (1962) views that

> "it is precisely during early school age that the higher intellectual functions, whose main features are reflective awareness and deliberate control, come to the fore in the developmental processes" (p 90).

And, according to Vygotsky, language plays an important role in the development of thought.

Of direct relevance to the present study is the fact that Donaldson stresses the importance of the effects of <u>written</u> language. She contends that "those very features of the written words which encourage awareness of language, may also encourage awareness of one's own thinking and be relevant to the development of intellectual self-control, with incalculable consequences for the development of the kinds of thinking which are characteristic of logic, mathematics and the sciences" (p 25). In this context, both Donaldson (1978) and Olson (1977) make the not too dissimilar point that in his contact with the written language, the child moves from the embedded context (Donaldson's term) where the situation makes immediate sense to the child, to disembedded contexts (also Donaldson's term) which typically involve situations that are beyond the here and now and require more <u>deliberate</u> thinking. In Olson's terms, there is a move from <u>utterance</u> (contextualised language) to <u>text</u> (decontextualised language).

After he discusses the differences between the written and spoken language, Olson (1977) argues that the written language requires the reader to deal with linguistically conveyed context apart from the nonlinguistic context that usually accompanies spoken language. In this sense, it may be reasonable to suggest that understanding a written text involves the same sort of decontextualisation of language evident to metalinguistic activities.

According to Donaldson (1978), it is this removal of language from its context and its resultant effect of prevailing over the use of other knowledge that makes many aspects of schooling so difficult for children

[9]. It may be that language use increases in difficulty along a dimension of context-embedded to context-reduced tasks.

This brief discussion of some theoretical positions indicates that the extent to which metalinguistic awareness is just another component of metacognition on a par with, for example, metalearning or metamemory, is still a debatable issue. The relationship between children's metalinguistic abilities and general development is not readily apparent. Furthermore, the hypothesis discussed above, that literacy may underlie the development of metalinguistic awareness in individuals, though well-motivated, still awaits empirical evidence. Therefore, a study which can isolate the main variables, namely literacy and maturation as well as clarify the exact role of each of them, is required and long overdue.

One contribution to the issue, we hope, will be afforded by the present study. Thus, by examining literate and illiterate children and adults, we will be in a position to deconfound such important variables as literacy and age. Furthermore, if we can establish that metalinguistic knowledge is indeed affected by literacy, we will be able to answer another question: In what way does literacy shape our conception of language? In particular, in what way does indoctrination into a particular writing system alter our consciousness of language?

C. Metalinguistic Awareness and Learning to Read

An important implication of the research on metalinguistic abilities concerns the problem of learning to read. Several researchers (eg Liberman et al, 1977; Mattingly, 1979; Ryan, 1979; Chomsky, 1979) have studied metalinguistic knowledge with a concern for educational purposes under the assumption that the acquisition of reading may involve certain metalinguistic skills. Some researchers (eg Mattingly, 1979) have assumed that the major stumbling block in learning an alphabetic system is the ability to make explicit judgements about the sound of speech. The amount of awareness needed to be able to enter the world of literacy is at the centre of debate.

Early observations by Vygotsky (1934/1962) indicated that the abstract nature of the reading task requires deliberate attention to sentence structure beyond the spontaneous use of structure typical in normal speaking and listening. This distinction between deliberate control over language structure and spontaneous linguistic skills has proved useful in characterizing cognitive advances during the early school years in abilities to deal with language stimuli.

Reading being a derived skill in that it builds upon language, beginning readers must bring their knowledge of the spoken language to bear on the written language. Thus, the phonics approach to reading requires the beginner to make sound-symbol associations between phonemes and graphemes. But above all, the child must be aware that words are made up of component sounds. On the other hand, the global approach to reading requires that the child be aware of word boundaries. In this sense, a reciprocal relationship may exist between reading experience and metalinguistic awareness. Their causal relationship, however, is a matter of great debate (eg Morais et al, 1979; Bradley and Bryant, 1983, 1985; Content, 1984; Zifcak, 1981).

To some researchers (eg Mattingly, 1978, 1979) the ability to reflect upon language, appears to be a prerequisite for being able to learn to read in that it would, presumably, enable the child to discover those properties of the spoken language that are central to the grapheme-phoneme correspondence. Mattingly (1978), for example, describes linguistic awareness, which he considers to be a prerequisite for learning to read, as "the ability of a speaker-hearer to bring to bear rather deliberately, the grammatical, and in particular the phonological awareness he does have in the course of reading". The same point is made by Downing (1977) who argues that in developing literacy skills a child "has to become aware of his own language behaviour if he is to understand how written language operates".

Direct experimental evidence to specify whether metalinguistic awareness is a prerequisite for or a consequence of literacy is lacking, however. Many of the claims are made from studies which are correlational. As in any correlational study, the direction of causation is unclear. One sort of observation which is sometimes invoked in support of the claim that linguistic awareness is a prerequisite, consists of no more than the statement that preschool children are deficient in a variety of tasks that require explicit phonological analysis (eg Le Roy-Boussion, 1975). These studies tell us much that is useful but they are not capable of clarifying the nature of the relationship and the inferences about the role of such metalinguistic knowledge in the acquisition of reading skill.

Finally, an interactive view has been suggested by one study (Ehri, 1979). Ehri suggests that phonological awareness is both a facilitator and a consequence of the reader's familiarity with print. This study, however, was based on normal preliterate (not illiterate) children who were compared to older children with poor reading ability.

In any event, any findings will be limited by the homogeneous nature of the sample with regard to their native language, their culture and their social class. It will be recalled that in most literate cultures, age and grade correlate almost perfectly. In other words, all of these factors may have conspired to produce such homogeneity in the results.

In sum, given this situation, it is not quite possible to determine which factors are responsible for the ability to read. When he is not read to, a preliterate child in a literate society watches T.V, "reads" graphological or pictorial signs on his box of cereals every morning, as well as traffic and other signs explained by literate caretakers. This literate environment tends to foster the growth of metalinguistic knowledge. There is no way of knowing what effects the special treatment of children in a literate society may have had on their linguistic and metalinguistic development before they are "officially" introduced to the rudiments of reading and writing.

Recent studies (Heath, 1982; Snow, 1983) have, indeed, indicated that middle class homes prepare children for written forms of literacy by providing literate features in oral discourse: that is, by telling or reading stories in which the author is impersonal, the setting is distanced, deictic contrasts have to be understood from the writer's or speaker's point of view, and relatively complex language forms are used. According to Scollon and Scollon (quoted in Snow, 1983) such features show up in very young middle class children's own oral stories long before they learn to read or write.

For many children in literate societies, the acquisition of reading is a developmental task imposed by society and mediated by the significant adults in the children's lives. To these children reading is a natural part of growing up.

D. Metalinguistic Awareness and Bilingualism

Another line of research in the area of metalinguistic awareness considers the relationship between bilingualism and metalinguistic knowledge. Those researchers who have paid attention to this question (and they are as yet very few) have reported some evidence that bilingualism can promote an analytic orientation to language and thus, may increase aspects of metalinguisitic awareness (Ianco Worall, 1972; Wetstone,1977; Ben-Zeev, 1977). Ben-Zeev, for example, reported that in comparison to monolingual children, bilinguals were better able to treat sentence structure analytically and also performed better on several nonverbal tasks which required perceptual analysis.

The finding that bilingual children display a more analytic orientation to language than their monolingual peers reflects, in a way, some views of Vygotsky (1962) who argued that being able to express the same thought in different languages will enable the child to

> "see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations" (p 110).

However, and as we also demonstrate in Chapter 2 when we discuss our pilot studies which also included bilingual Subjects, there are at least two problems with past research on the relationship that may exist between bilingualism and metalinguistic awareness. First, studies do not always make a distinction between coordiate bilinguals, ie those children who are required to acquire a second language, usually on entrance to school and compound bilinguals, ie those children who are exposed to two languages from birth. The distinction is very important here, for as Lambert (1977) also pointed out but for different reasons, a situation of 'additive bilingualism' where the second language is regarded as an added skill which does not overtake the home language, may present a different picture from a situation of 'subtractive bilingualism' where the home language is devalued in its process of acquiring a second language. Indeed, Cummins (1978) demonstrates that this analytic orientation to language hypothesised by, for example, Ben-Zeev is a result of actually functioning in two languages rather than the language learning experience per se.

Second, the tasks used in these studies (Ianco-Worall, 1972; Cummins, 1978) for the most part are concerned with an ability that bilingualism per se may strengthen, eg separation of the name of an object from the attributes of the object (Could a cow be a horse? Would a cow neigh?) or being able to relate words in terms of phonetic relatedness (cap-hat) may call upon the particular strength of the young bilingual to generalise across particular phonological sequences to access meaning.

E. Metalinguistic Awareness and Linguistic Theorizing

By using findings from experimental psycholinguistic research, some researchers, although few in number, have investigated metalinguistic awareness in an attempt to shed some light on methodological issues in linguistic theorizing and gain some insight into such aspect of linguistic structure as the notion of syllable, segment, word, etc. (Treiman, 1979, 1983; Treiman and Breaux, 1982; Fallows, 1981; Ringen, 1979; Derwing, 1979, 1984).

In a sense, metalinguistic awareness has its sources in the generative paradigm with its notion of native speaker's intuitive judgements. Thus, linguists within the generative paradigm not only assume that native speakers have internalised rules which enable them to produce and comprehend an infinite number of utterances, but also that they know something about these utterances, although they have no consciousness of the rules themselves. For example, a native speaker has the ability to judge that some utterances are tokens of expressions having certain properties (eg acceptability judgments), or standing in certain relations to others (eg paraphrase or synonymy) or that a certain phonetic contrast is distinctive in his language. These sorts of abilities are usually referred to by generative linguists as native speakers' intuitive judgements, and by psycholinguists as native speaker's metalinguistic judgements. This is not to be viewed as a simple terminological difference. The terms used are not theoretically neutral. But this is an issue on which I do not propose to embark at present. It is important to point out, however, that linguists have made the assumption that all adult native speakers share the same linguistic competence and that this should show up reliably in their intuitive judgments of grammaticality, relatedness and acceptability. Indeed, one corollary of the notion that there is a uniform linguistic competence is the idea that there are no individual differences in language ability (see Snow, 1975; Spencer, 1973).

1. Individual Differences in Language and Language Performance

Psycholinguists as well as sociolinguists have been critical of this. The idea of universal equal competence has been questioned in a number of ways. Critics (Hymes, 1974; Caroll, 1979; Fillmore, 1979; Ross, 1979; Gleitman and Gleitman, 1979) of the equal competence hypothesis claim that there is no strong empirical evidence linking equal speech production mechanism to grammatically defined processes.

Hymes (1974), for example, notes that although inequalities have been observed, many linguists are reluctant to address them because their existence among native speakers could imply varying levels of competence and thus, seriously threaten the validity of uniform linguistic competence. A psycholinguist, Ryan (1980) warns that it is hazardous to assume that similar performance in some situations must imply equivalent underlying cognitive structures. Equally wrong is to dismiss erroneous linguistic performance as indicative only of the influence of "unimportant factors".

An extreme view is that competence is not as uniform as it is claimed to be and that the dichotomy competence/performance ought to be scrutinized. This has led Carroll (1979) to suggest the necessity "to extend the notion of competence to describe a whole range of competences (with emphasis on the plural), not only those with implicit knowledge of language rules, but also those having to do with the characteristic abilities of speakers (or writers) to use their linguistic knowledge to produce effective communication, to retrieve particular types of linguistic knowledge when called for, or to adapt their speech or writing styles to the demands of different occasions" (p 15).

All things considered, variability is pervasive in all psychological systems and it would be surprising if linguistic variabilities and inequalities were not found among native speakers. Surely education in general, literacy in particular, makes a difference [10]. Indeed, empirical research has shown differences among different social classes and groups in certain aspects of language performance. These inequalities among adults have been observed and sometimes assessed. Thus, some linguists have had the problem that their own judgemental performances do not agree with the judgements of the nonlinguists, even though they speak the "same" language. In fact, they sometimes have to face the problem that their own judgements do not accord closely with judgements from other linguists working within the same paradigm, (Spencer, 1973; Gleitman, 1979; Ross, 1979; Fillmore et al, 1979) [11]. The same individual differences were also found among children during the course of language acquisition (Peters, 1977; Nelson, 1973; Dore, 1974; Ferguson, 1979; Horgan, 1977, 1980; Ramer, 1976) and among second language learners (Krashen, 1976, 1978). In what follows we briefly review some of these studies and consider their implications for research on individual differences and metalinguistic abilities.

1.1 Individual Differences in Language Acquisition

A search in the literature on early language acquisition reveals that in early language production, children are not uniform. There is variation within and across children. Where evidence has been gathered for these differences, great variability is noted. Researchers have used various terms to describe this variation.

Peters (1977) proposes that children may differentially exhibit two strategies during their early language production. One has been labelled analytic utterance (the 'nice neat one-word utterance' which slowly matches the adults'). In the second strategy or type, which has been labelled gestalt [12], utterance segmentation is rather poor.

What you have are chunks of utterances. According to Peters, analytic language is used in such referential contexts as naming things (eg pictures in a book). Gestalt language is made use of by the child in sociable contexts (social interaction) such as playing with a sibling or in commenting about objects rather than naming them.

Similarly, Nelson (1973) has proposed that during the course of language acquisition, some children use language to talk about language; others, however, decide that their primary need for language is for social interaction. In her study, Nelson used first-and second-born middle class children who ranged in age between 10 and 15 months. She noticed that there was a tendency for first-born children (7 of 11 children) to be analytic (she uses referential), and for second-born children (4 of 7 children) to be gestaltic (she uses expressive). This was not statistically significant given the small sample. When, however, the parents' educational background was controlled for, the study revealed that <u>all</u> of the first-born children of the most highly educated families (those with college education and better) were found to be referentially oriented. Although we have to be cautious in drawing conclusions based on one study, it is nevertheless worthwhile to note that factors such as social and more importantly educational background, might affect the linguistic input to children, which in turn could affect the acquirer's linguistic process. More specifically, it points to the source of variation in the initial utterance extraction strategy which the child's referential or expressive orientation underlies. Of particular interest to our study is whether "referentially oriented children" grow to become more aware of the units of their language after full acquisition, and thus, more metalinguistically able than their 'expressive' peers.

Dore (1974) studied what are called primitive speech acts, which consists of single words or single prosodic pattern that function to convey an intention. Some of the primitive speech acts were observed to include labelling, repeating, requesting an action, requesting an answer, greeting, protesting and practising. Dore observed two children and found a distinction similar to that found in Nelson (1973, 1975). One child, a girl, evidenced what Dore termed the "code oriented style" which was made up of labelling, repeating and practising words. It consisted mainly of speech acts which were not addressed to other people. The other child, a boy, used what Dore called the "message oriented style", a style which used language mainly to manipulate other people.

Ferguson (1979) in a review of individual strategies for the acquisition of phonology noticed two types of learners. One type is the "cautious system-builder" who acquires new vocabulary slowly and does not attempt a new word unless it is within or just outside his current system. This child is less likely to imitate adults' utterances than children of the other learning style. Children of the opposite style are imitative and attempt new words beyond current capabilities. These children evidently show a loose and variable phonological organisation.

Finally, Horgan (1977, 1980) and Ramer (1976) examined the complexity and patterning of speech in slow and fast language learners. Horgan reports that the more precocious children tend to produce longer and more elaborate noun phrases and generally talk more about people and things. The slower children have larger verb phrases and tend to engage in less description of people and things. Ramer (1976) reports that the expressive style is typical of children who are slow at language learning overall. She also found strong gender differences, with boys being slow and expressive, girls being fast and referential. Horgan (1977) also found that the language acquisition style which seems to be used more by girls, is more productive (analytic) and descriptive. The other style associated with later and/or slower acquisition is used more by boys, is expressive (personmal, social) and contains more whole "unanalyzed" forms.

1.2 Individual Differences in Second Language Learning

In second language learning, Krashen (1976) has proposed that second language users possess two possibly independent systems in speech, one an 'acquired' system whose rules are subconscious and are internalised by use and exposure to linguistic data. The other system makes use of consciously learned grammatical rules (the "monitor"). Differential use of the two systems may be able to explain success in various aspects of second language acquisition. Krashen (1978) notes that some second language learners do not seem to utilize a conscious grammar at all, and rely mostly on their "feel" for correctness. Others, however, 'monitor' their language use all the time, and as a result of which they exhibit little fluency (see also Wong Fillmore, 1979; Gass, 1983).

In summary, except for obvious questions of dialect, individual differences in language abilities and language performance remained peripheral to the interest of researchers working within mainstream linguistics. This variability in performance is often acknowledged by some linguists, but equally often dismissed as due to theoretically unimportant factors. Where it is recognised at all, it is generally reserved for explaining the language behaviour of children, foreigners, or speech impaired patients.

III The Literate Bias in Linguistic and Psycholinguistic Research

Despite references from time to time by main stream linguists to 'normal' native speakers, what is meant by "normal" is never spelled out in any detail. The fact remains that the native speaker who features in the majority of the linguistic literature is male, middle-aged, middle-class, monolingual/-lectal, and above all literate. Even in psycholinguistic research, the experimental subject par excellence is the college sophomore.

The lack of investigation of illiterate speakers is partly understandable for most research has been conducted in cultures where literacy is taken for granted. For example, what little we know about metalinguistic awareness comes from research based on children from literate cultures for whom chronological age and school grade correlate almost perfectly. There are no 'normal' <u>illiterate</u> children in such cultures, only normal <u>preliterate</u> children. Furthermore, much of the available data in reports and diaries are often contributed by a sample of children whose upbringing can hardly be described as representative even in these literate cultures. Indeed, much of the evidence that has been reported comes from observations of the children of academic investigators [13]. Children in university-run nursery schools hardly constitute a representative or random sample.

As adults, most native speakers of a literate-culture language such as English (we note here that most psycholinguistic research was conducted with native speakers of English) are subject to systematic exposure to particular views about the grammar of their language during the years of schooling, and thus they gain insight into structural aspects of their tacit knowledge. Becoming literate brings about the development of linguistic notions that might otherwise never arise. Furthermore, reflecting upon one's language leads to modifying one's own language use. It is not implausible, therefore, that educational processes through which a native speaker passes may play an interesting role in shaping native speakers intuitions and changing their consciousness of their language. As Gray (1981) observes,

> "there is indeed an important difference between obtaining the English language from an English informant and obtaining the Tagalog language from a Tagalog informant" (p 203).

In this context, it is perhaps important to remind ourselves that the traditional goal of the study of grammar was the improvement of command of language, and in particular the improvement of written language. As

Stenning (1979) put it

> "looking at transformational linguists' practice, it is not difficult to see that the product is a grammar of a species of the written word, and this is inevitable and fitting when the intuitions that are evidence for the grammar presuppose a literate attitude to language" (p 421) (emphasis not in text).

In the same vein, Olson (1977) proposes that

> "Chomsky's theory is not a theory of language generally but a theory of a particular specialised form of language assumed by Luther, exploited by the British Essayists, and formalised by the logical positivists" (p 272).

It is a model for the structure of "autonomous written prose" (p 272), or what Olson also calls text.

Similarly, Moore et al (1979) write:

> "In the case of a great deal of Chomsky's data, it has often been difficult to know whether the sentoids output by the model were to be put in correspondence with sentences of written or spoken language" (p 165).

Judgements are usually oriented to norms of written communicaitons.

Given a literate society and a cultural context where the native speaker's view of language is shaped by his educational background, based on the authority of grammar books and dictionaries, the strategy favoured by modern linguistics in obtaining data from native speakers is hardly surprising.

In sum, it is the case that while formal analyses of languages reveal sophisticated rules, they do not always address themselves to the abilities of the users of the language. Linguists have been looking at the product (language) and have neglected the producer-user. Idealisation does not, in principle, resolve the issue of who should be entitled to supply the data. Any theory of language that proposes to study data but ignores the data supplier is bound to be unrevealing. Segmenting speech into linguistic units or giving intuitive judgements of sentences is not revealing unless we know who is doing it. It is appropriate to ask, as Elliot (1981) does, whether the ability to make grammatical judgements about isolated sentences, for example, is a fundamental one, necessary for every competent speaker of the language however young or illiterate he may be, or whether it is a relatively specialised ability, widespread among western adults but none the less a byproduct of our literate culture (p 13). Intuitions among literates are not untutored [14]; there are degrees of intuitions.

IV Summary of Structure of the Thesis

In this chapter which is preliminary in nature, we have outlined the conceptual framework and focused on some theoretical issues associated with metalinguistic awareness.

The point of departure of this introductory chapter is the native speaker. It has focused on the fact that the linguistic knowledge a native speaker is assumed to possess enables him not only to perform the 'basic linguistic capacities' (Bever 1970) such as perceiving and producing an unlimited number of utterances, but also to judge utterances, segment words, identify sounds and detect ambiguities.

In attempting to characterize the intricate factors involved in these metalinguistic abilities, this chapter has clearly indicated that the phenomenon at hand is not as straightforward an issue as it may appear. Indeed, the diversity of research and the divergence of opinion regarding the nature of metalinguistic knowledge and its relation to other cognitive phenomena reflects the difficulty of researching this area, which straddles both psychology and linguistics.

Both conceptually and methodologically, the notion of metalinguistic awareness is still debatable. No one unequivocal definition is available at present and terms have been characterized according to the research aims of the investigators. An assessment of the phenomenon is yet to be articulated.

In discussing the theoretical framework, this chapter has argued that many conclusions reached by some researchers are rather hasty and for the most part inadequate. In particular, we have detailed several arguments advanced which support the view that the emergence of the metalinguistic awareness is related to maturational advances in the child. We have pointed out why these authors reached such conclusions and were led to make such claims. Each one of these arguments was found either to make the wrong predictions or to be factually inaccurate.

Thus, we have found that most of the evidence for the maturation hypothesis is ambiguous. Studies which have attempted to investigate metalinguistic knowledge in children have repeatedly employed literate and preliterate (not illiterate) children. The two groups inevitably had different ages with literates older, since age and grade in most literate societies correlate almost perfectly. Are the results attributable to maturation or to the fact that subjects were literate? Futhermore, the emergence of metalinguistic ability during middle childhood (eg Hakes, 1980) is rather suspicious, for it is precisely during this period that a typical literate culture-child is exposed to extensive reading and writing. In this sense, it is not unreasonable to suggest that developmental cognitive research in literate societies has been studying the consequences of literacy and growing up in a literate context rather than the laws of human development.

Similarly, because most studies have been conducted with children from literate environments which tend to foster the growth of metalinguistic knowledge, there is no way of knowing what effects the special treatment of literate-society children may have had on their linguistic and metalinguistic development before they are introduced to the basics of reading and writing. In other words, all of these factors may have conspired to produce such homogeneity in the results.

A second function of the present chapter has been to suggest that it is essential to consider literacy as a crucial factor in our investigation of metalinguistic awareness. Specifically, we hypothesize that in literate cultures the concepts of such speech units as word, syllable and segment which children and adults acquire are mainly a result of their indoctrination into a particular writing system. It is unlikely, we contend, that native speakers' linguistic knowledge remains unaffected by their becoming literate. Citing Donaldson (1978) with approval, we hypothesize that decoding written language enhances linguistic awareness.

By using literate and illiterate children and adults as subjects, the present study was specifically designed to elucidate the processes underlying metalinguistic awareness and to trace its relationship to maturation and literacy. If we can establish that literacy is an essential ingredient in the process of metalinguistic awareness (as we hope the present study will make a contribution to doing), then, claims for purely maturational advances will be shown to rest on inadequate methodological procedures. By the same token, we shall be further able to demonstrate that the assumption that all adults are capable of metalinguistic reflection, as indeed is held (however implicitly) by many researchers is inaccurate.

A third and important function of the present chapter has been to argue that much work in the past has been rather narrow, tending to concentrate in particular on metalinguistic awareness as a psychological process but often ignoring the linguistic processes. By focusing on the linguistic aspect, the present study adds yet another dimension to metalinguistic research. In particular, we propose to focus on the following:

(i) as most research in metalinguistic knowledge (and most psycholinguistic research, for that matter) has employed native speakers of English, the present work was designed to use subjects who are native speakers of a language which is typologically different from English, namely, Arabic.

(ii) in the past, research on the relationship between oral and written language has been, in the main, concerned with exploring the influence of speech on writing. In the majority of cases written language is considered as secondary and dependent on the spoken variety. If we can show that awareness of spoken language can be mediated through written language, then we shall be able to challenge the view that language is speech and, by implication, that writing is a codification of speech, a view which has its sources in the history of linguistics (eg Bloomfield, 1933). The present work will go some way toward this.

In sum, the present study sets out to view the notion of metalinguistic awareness as encompassing the following two aspects:

(i) the ability to reflect on language and to contemplate it as an object of analysis in its own right;

(ii) the explicit knowledge (eg segmentation, identification, extraction, manipulation) of linguistic properties of one's language which are obtained via intuitions.

In this context, the present chapter has examined the notion of intuitive judgment in linguistic theorizing, and has proposed that intuition-having be regarded as a cognititve act that should be investigated in its own right. More importantly, it has argued that educational processes through which a native speaker passes may play an important role in shaping native speakers' intuitive judgements of grammaticality and acceptability, for example. Concerning phonological awareness, for instance, we hypothesize that the literates' ability to attend to and manipulate speech segments may be attributable to some 'perceptual set' that they have acquired in the process of becoming literate. Thus, their awareness of speech segments may be shown to be based on their knowledge of an alphabetic writing system, and in general, on literate culture indoctrination which reinforces this habit. We further conjecture that people with different writing scripts may differ in their awareness of various linguistic units according to the nature of their orthography.

Now that the broad conceptual issues have been discussed and most research questions made clear, we shall map out the geography of the present thesis.

In the first chapter we have tried to provide an introduction to the theoretical issues which we think are of central importance to the topic under investigation and at the same time to lay a foundation for subsequent chapters.

Because our approach is essentially psycholinguistic, Chapter II describes and discusses the general design and methodology employed to gather the necessary data and procedures used to evaluate these data. In an effort to show in what way the present work is methodologically different, methodological issues are raised and reference is made to various previous studies in the literature including our own pilot studies. In considering the need for cross-cultural and cross-linguistic research as an antidote to the current climate in metalinguistic research, Chapter II discusses the reasons for conducting the experimental work in Morocco.

Chapters III, IV and V form the main bulk of the research. Using various experiments, these chapters examine the extent to which literate and illiterate children and adults deploy their metalinguistic knowledge in the process of attending to and manipulating the following linguistic units:

(i) words (Chapter III)
(ii) syllables (Chapter IV)
(iii) segments (Chapter V)

Typically, each one of these chapters considers various hypotheses and research questions which concern the specific linguistic unit. In seeking to determine what is known about a specific unit that might be relevant to the understanding of the problems that may face subjects in performing various metalinguistic tasks, each chapter examines the status of the appropriate linguistic unit in general linguistic theory and linguistic behaviour. Furthermore, with the purpose of the study in mind, each one of these chapters considers the relevant hypotheses and research questions which concern the unit they deal with. They also discuss the results in the light of findings and hypotheses proposed.

Finally, Chapter VI draws general conclusions from the general study and addresses some implications for linguistic theory, psycholinguistic research and, although not extensively, educational research.

FOOTNOTES

1. Furthermore, the emphasis upon what goes on between the ages of 18 months and four years has led to the relative neglect of development in language from age four onwards. Interestingly, it would appear that metalinguistic awareness tends to 'flourish' during middle childhood, ie between four and eight (Hakes, 1980).

2. This is not intended to suggest that comprehension or production never involve controlled processing. There are clearly cases in which they do. For example, there are occasions in which one literally chooses one's words carefully with deliberation and awareness. The suggestion is that normal comprehension processing is highly automatic. cannversely, metalinguistic knowledge also arise relatively spontaneously. A breakdown in the automatic processing system may yield controlled processing and one becomes aware of that. For example, one might produce alliteration in the course of normal speaking, but this is not the same as intentional alliteration (see Chapter 4).

3. Following Bialystok (1981), the term awareness - which is used throughout - is not to be interpreted as 'consciousness'. Awareness, as it is used here, is closer in meaning to 'knowledge' than it is to 'consciousness' (but see Chomsky, 1979 and Marcel, 1983).

4. By literacy, we mean those activities and skills which are associated directly with the use of print - primarily reading and writing (see Snow, 1983). This is different from, for example, Tannen's (1982) use of literacy which refers to literate oral discourse (also literate conversational styles). Literate oral discourse, however, may be a potential facilitator for graphic literacy. In all events literacy involves the knowledge that language can be treated opaquely, that it exists as an artifact and that it is composed of units and subunits.

5. Marshall and Morton put forth the argument that while monitoring processes have 'access' to language structure, such access need not imply awareness.

6. <u>Translation</u>: "The ability to segment words does not depend on a specific skill, but results from an active process of reconstruction linked with the child's general cognitive development and with his capacity to step aside from the word and to think about it as an object.

7. To add to an already difficult research situation, Eson and Walmsley (1980) hypothesize that the child's awareness of language should occur at around 10 to 12 years of age because metalinguistic

awareness is related to the development of 'semiformal' thought which exists prior to formal thought in Piaget's formulation.

8. Goody (1977) has examined in detail the significance of lists and tables that are very common in what remains of written material from about 3500 BC. He notes that various types of lists were made for trading and other administrative purposes. He further argues that such lists of property, people, transactions have no direct oral equivalent. Speakers do not commonly produce lists (although they can if the are so required). Lists are not speech written down. Rather, they are a distinct written (semiotic) form used as side-memoire. Orality knows no lists or charts or figures. According to Ong (1982), "writing was in a sense invented largely to make something like lists" (p 99). Put another way, writing is not speech written down (see Chapters 5 and 6 of the present study).

9. In this context it is worth noting with Goody (1977) in his description of the growth of schools in ancient Summerian society that "the whole process of removing children from the family, placing them under distinct authority, can be described as one of the decontextualisation, formalisation, for schools inevitably place an emphasis on the 'unnatural', 'oral', decontextualised process of repetition, copying, verbatim memory'.

10. One might insist, however, that education merely eliminates performance errors, allowing actual performance to approximate underlying competence more closely. But, as Stich (1981) argues, it is hard to see how anyone is in a position to insist on this <u>a priori</u>. "The view has about as much to recommend it as the parallel suggestion that in teaching Eliza Dolittle to speak the English of artistocracy, Henry Higgins was simply eliminating performance errors and enabling an underlying aristocratic linguistic competence to shine through" (p 354, in a comment on inferential competence).

11. A recent article by Caroll, Bever and Pollack (1981) which investigated native speakers' intuitions of sentence relatedness, revealed that linguistic intuitions can be manipulated (in this case by using mirrors) by altering the conditions under which sentence pairs are presented. The implications of this study are very important in that the relationship between grammatical structures and intuitions has been questioned. In this sense, and as pointed out by the above authors, "linguistic intuitions have dual systematic nature. On the one hand, they can be basic and primitive manifestations of the grammatical knowledge speakers share; but on the other hand, they are complex behavioural performances that can be properly understood and adequately interpreted only by a comprehensive analysis" (p 380). Put simply, to speak of native speakers' intuitions merely transposes the obfuscation to a psychological level: Intuition-giving is a cognitive act which must be investigated in its own right.

12. While Peters (1977) uses 'analytic', Nelson (1973) uses 'referential' and Halliday (1975) uses 'mathetic'. Analytic children have been observed to employ such single short words as 'book, picture, kitty cat' in self-talk with no attempt to communicate to the outside world, as if the association of the sound with the object were part of a cognitive process of recognition, as Peters suggests. Gestalt (Peters' term) or Expressive (Nelson's) or Pragmatic (Halliday's) are such utterances as 'I want that', 'do this', 'nice to see you'. Expressive or Pragmatic oriented children seem to produce proportionally longer utterances than the referentially-oriented. Their utterances tend to be formulaic and function to regulate social interaction.

13. Thus, data were contributed by, among others, Leopold's daughter, Hildegard (1949), Gleitman's daughter, Claire (1972), Smith's son, Nigel (1973), Halliday's Amhal (1975), Slobin's Heida (1978), and Kuczaj's Abe (1982).

14. To borrow an analogy made in Valian (1982), intuition-having is like wine-taking: it's a skill at which all are capable at some level, but which training and experience can cultivate.

CHAPTER TWO

I Introduction

Our approach being essentially psycholinguistic, this chapter seeks to describe and discuss the methodology employed to gather the necessary data for the study. It is also concerned with the procedures used to evaluate these data.

Since, however, the experiments had several different designs, this chapter does not provide a full description of the materials employed. Thus, the number of stimuli, their nature, type and distribution in each individual experiment will not be presented here but in the chapters dealing with particular sets of experiments.

On the other hand, more details than perhaps necessary, at least for the expert, are given in this chapter's sections on testing procedures and statistical methods. This is meant to facilitate interpretation of the results which will be presented in subsequent chapters. It is not trivial to remind ourselves that results are only as satisfactory as the corresponding experimental design and data analysis. Furthermore, and throughout this chapter, methodological issues are raised and reference is made to various previous studies in the literature in an effort to show in what way this work is methodologically different. Reference to our own pilot studies is also made whenever the need arises.

The chapter is organised in the following way. First, with the purpose of the study in mind, we state and discuss the reasons for conducting experimental work in Morocco. In particular, we show why this country provides an ideal setting for investigating both the developmental course of metalinguistic abilities and the effect of literacy. Then we describe and discuss the Subjects who participated in the research. Following this, we present the testing procedures common to all experiments. Finally, the statistical methods employed to analyse and evaluate the data are discussed.

II General Design

A. Testing Environment

1. The Setting

As stated in Chapter 1, one of the major problems in psycholinguistic research is that a disproportionate amount is specific to Indo-European languages. Most studies in metalinguistic awareness, for example, have been conducted with native speakers of English. The problem with this Anglocentrism is that any outcome would reflect, in part, peculiarities of the English language, and more importantly peculiarities of English speakers, rather than principles underlying metalinguistic abilities. One such peculiarity of native speakers of English is that they tend to be literate. Closely related to this concern is also the fact that in literate societies age and years of education are almost perfectly correlated.

On this view, it is not unreasonable to suggest that developmental cognitive research in literate societies has been studying the consequences of schooling and growing up in a literate environment rather than the laws of human development. Concerning metalinguistic awareness, Hakes (1982) observes that growing up in a literate environment with adult models who are themselves metalinguistically competent, fosters the emergence and growth of metalinguistic abilities in children in a variety of ways.

One highly relevant antidote to the current climate is cross-cultural and cross-linguistic psycholinguistic research. An interesting possibility is that variables which occur together in one culture, and hence which are confounded in any statistical analysis, can be studied separately in other cultures. In recent language acquisition research (Bowerman, 1981; MacWhinney <u>et al</u>, 1984; Slobin, 1982), cross-linguistic data have been especially powerful in modifying conclusions based on English language studies. In Slobin's (1978) words "When a theory of language acquisition fits the local circumstances so well, it is time to look abroad". In metalinguistic development, it does not seem unreasonable to start 'looking elsewhere'. The purpose of the present study is to do just that.

In order to examine circumstances quite different from the 'local' ones, the present study was conducted in Morocco. This country provides not only a population of illiterate children and adults, but an unequal distribution of educational facilities among the literates as well. Further, it offers the opportunity to add insight from yet another language typologically different from English, namely, Arabic.

The advantage of such a situation is two-fold. First, it enables us to test whether findings based on data from restricted subject populations are generalisable to other subjects. Secondly, and more importantly, it helps to 'deconfound' such theoretically important variables as age, literacy, grade and linguistic peculiarities of the native language. Concerning this last variable, it is a fact that researchers tend to equate language with speech which is primary and treat writing as a secondary form merely reflecting or recording speech. We contend that this view is unmotivated. By using literate and illiterate children and adults, we can disentangle the effects of maturation and indoctrination into a particular writing system. But we can already say with Olson (1977) that the invention of the alphabetic writing system has given the Western culture many of its predominant features including an altered conception or view of language (p 262).

2. The Educational System

The wide variation in schooling available in Morocco provides an ideal setting for investigating both the developmental course of metalinguistic abilities and the effect of literacy.

Literate and illiterate children vary in age owing to factors which either delayed the beginning of schooling for some or, on the contrary, brought it forward for others. Thus, although schooling is compulsory at the age of seven, some children are not enrolled in school until they are older. Paradoxically, others manage to begin their schooling at the age of six. This age overlap is clearly shown in the sample used in this study. Furthermore, while schooling is compulsory, it is still not universal and many children will never enter school or will drop out after one or two years. There is no minimum age at which children may discontinue their school education. This is not the place to enter into the many reasons which either delay the beginning of schooling for some children or prevent others from becoming literate. These reasons are not unlike those found in many developing countries. Any speculation would go beyond the scope of this thesis. Suffice it to say that the fact that there are illiterate children is not always due to any lack of readiness or intelligence, but simply to lack of opportunity.

In principle, Moroccan children first enter school in the autumn of the year in which they turn seven [1]. Until they reach that age, some of them attend what is know as Kuttab or Koranic school [2]. Typically, these one-classroom schools are open to young children to learn the basics of reading and writing [3]. Although many of these preliterate institutions have traded their wooden slates for notebooks and primers, rote learning, though decreasing, is the rule. This is mainly due to the inadequate training of instructors and the lack of availability of any instructional aids (see Wagner and Lotfi, 1980). Most children attend these 'schools', albeit erratically, for about one or two years before going on to a modern public school or, as Wagner and Lotfi (1980) put it, 'to no school at all'.

Primary school curriculum is uniform throughout the country if only because access to secondary school is decided on success in a state examination. In the first two years of primary education, emphasis is placed upon literacy (reading and writing) and numeracy (counting and arithmetic). Literacy is achieved not in the colloquial variety of Arabic (ie Moroccan Arabic which is the mother dialect of all the subjects used in the study), but in the written form (ie what has been variously termed as Classical Arabic, Modern Standard Arabic, and Literary or Written Arabic). The existence of the two varieties is mainly due to the diglossic situation in Arabic (see next section). It should be pointed out, however, that all the experiments were conducted in the spoken colloquial variety.

3. The Diglossic Situation

Of prime concern in any psycholinguistic experimenting is the language in which the Subjects are tested. In discussing the test language for the Subjects involved in this study, it is important to focus on the diglossic situation in Arabic.

There would not be much point in our describing diglossia [4] in any detail, since the situation has been portrayed in various other studies (eg Marcais, 1930; Ferguson, 1959; Schmidt, 1975; Ibrahim, 1983, 1985; Youssi, 1983). Further, it is not our purpose to reinforce the concept of diglossia in Arabic (see Badawi, 1973; Daltas, 1980; and especially El Hassan, 1977, for a critical review of diglossia and related concepts) [5]. Suffice it to note that the central issue in Arabic literacy acquisition is the distance which separates the language of the learner (Colloquial Arabic) from that of the classroom (Standard Arabic). Acquiring literacy involves learning a different form of Arabic from the one acquired as a native language. Although the differences between dialects of spoken Arabic and standard Arabic have yet to be studied extensively, it is safe to claim, with Ibrahim (1983) that to speakers of all varieties of Arabic, acquiring literacy means learning a new system of syntactic rules, an immensely different morphology, a vast number of lexical items which either have no cognates in the spoken variety (or varieties) or have very different meanings, and finally a greatly modified phonological system from the one acquired in childhood (p 511). Because the two language forms are sharply divergent, an Arabic speaking learner seeking to become literate in his own language is confronted with a difficulty which has sometimes been compared to that of attaining literacy in a second language (see Ibrahim, (1983), for example). This is based on the assumption that a close correspondence between the spoken and the written forms of a language facilitates the acquisition of literacy. In the absence of much needed research on the effects of a diglossic situation on the acquisition of literacy in Arabic, it is difficult to evaluate this conclusion.

A more relevant question to the present work is: does the diglossic situation as discussed above affect metalinguistic knowledge? This study provides preliminary information on this issue. We predict, for example, that familiarity with Modern Standard Arabic (ie the written variety) provides literate speakers with new lexical informatiton, which might affect the structure and hence their awareness of the already existing lexicon.

B. Subjects

The general experimental design required four groups of subjects (Ss): Literate children, illiterate children, literate adults and illiterate adults. A total of 120 Ss, of whom 72 were children (36 literate and 36 illiterate) and 48 were adults (24 literate and 24 illiterate), participated in this study [6]. The sample was drawn from a relatively homogeneous socioeconomic background details of which are indicated below in the appropriate sections dealing with each group sample [7].

1. Selection of Ss

(i) No child or adult who was bilingual served as S. Only monolingual Moroccan Arabic speaking Ss participated. Although our pilot studies had included bilingual speakers of Arabic and Berber, three considerations led to exclude them from the present study. First, the general finding (Ben-Zeev, 1977; Ianco-Worall, 1972; Wetstone, 1977; Cumming, 1978) that bilinguals performed differently from monolinguals and that bilingualism might promote metalinguistic awareness was not borne out by the results from our pilot work [8]. The second reason was a practical one. While bilingual adults are easily available, bilingual children are not - at least not in the age range used in the study and in the area where it was conducted. The third and final reason was that to have included yet a new variable as bilingualism in an already large study would simply have been unwise. The effect of bilingualism on metalinguistic abilities should await future investigations.

(ii) In view of the proposal (Hakes, 1980) that the years from four to eight may be very important ones for the development of metalinguistic awareness, no child younger than 4;8 or older than 8;6 was included in the present study [9]. Furthermore, it is during the age range 6-8 that schooling starts in Morocco. This is one of the reasons why we concentrated on a relatively large number of child Ss (74%) at these two ages [10] (see distribution below).

(iii) No schooled child who has had at any time repeated a grade was included.

(iv) Teachers were at no point consulted about drawing up lists of participants. Some teacher bias towards selecting good pupils had been observed during pilot work. The school register served as a basis for drawing participants.

(v) All illiterate Ss (children and adults) were screened for reading ability. Two five-line paragraphs, one of which was fully vowelised [11], were employed as reading passages.

1.1 Child Sample

The child sample included 72 children. Of these 36 were literate and as many were illiterate. Although no extensive biographical data were collected, it was assumed that both groups were comparable in socioeconomic status as based on neighbourhood and school location [12].

1.1.1 Literate Sample

The literate child sample (CHLIT) consisted of 18 males and 18 females drawn from two grades (first and second) with 18 children from each grade. At first testing, ages of the sample ranged from 6;1 to 8;6 with a mean of 7;4, a median of 7;7 and a standard deviation of 1.43. A summary of the literate child sample with respect to distribution of age, gender and grade is displayed in Table 3.1.

	Age Range	Gender M	F	N
Grade 1	Under 6	0	0	0
	6 - 7	5	4	9
	7 - 8	3	5	8
	over 8	0	1	1
		8	10	18
Grade 2	Under 6	0	0	0
	6 - 7	1	0	1
	7 - 8	6	5	11
	over 8	3	3	6
		10	8	18

TABLE 3.1 - Literate Child Sample : Distribution of Ss by age, gender and grade.

The sample was drawn from two mixed modern public primary schools located within the same neighbourhood in Rabat. Both institutions are within the state education system and hence have the same curriculum.

1.1.2 Illiterate Sample

The illiterate child sample (CHILT) consisted of 36 children (20 males and 16 females) drawn from three sources: a Koranic school (or Kuttab), a daycare centre and personal contacts. Ages of the sample at first testing ranged from 4;10 to 7;9 with a mean of 6;3, a median of 6;4 and a standard deviation of 1.20. Details of this sample are represented in Table 3.2.

Age Range	Gender M	Gender F	N
Under 6	6	6	12
6 - 7	7	6	13
7 - 8	7	4	11
over 8	0	0	0
	20	16	36

TABLE 3.2 - Illiterate Child Sample : Distribution of Ss by age and gender.

1.2 Adult Sample

The adult comparison sample comprised 48 men and women. Half of these literate and half illiterate. They were all volunteers and received no rewards for participating in the study. All Ss were ignorant as to the purpose of the study.

'1.2.1 Literate Sample

The adult population (ADLIT) included 24 Ss (14 males and 10 females). Ages of the sample ranged from 19 to 31 with a mean age of approximately 26 years.

The educational background in these Ss was varied with a minimum of four to five years of schooling and a maximum of 10 (Mean = 7.04). All had attended school as children and all achieved literacy through schooling. None of them was self-taught or had become literate as a consequence of a literacy campaign for adults. A total of nine Ss never went beyond primary education and no S reached the final secondary school year [13]. Table 3.3 indicates the distribution of Ss as a function of their gender and the number of years of schooling.

Years of Schooling	Gender M	F	N
4 - 5	2	0	2
6	7	0	7
7	2	3	5
8	1	2	3
9	2	3	5
10	0	2	2
	14	10	24

TABLE 3.3 - Literate Adult Sample : Distribution of Ss by gender and years of schooling.

Although care was taken that only those literate Ss who were educated in Arabic took part in the study, it is not easy to control for some knowledge of French by some Ss.

1.2.2 Illiterate Sample

The illiterate adult population (ADILT) consisted of 24 Ss (14 males and 10 females) [14]. The age range varied from early 20's to mid 50's with a mean age of approximately 35 years.

The entire sample was screened for reading ability. The procedure was the same as the one employed with illiterate children. None of the Ss in this sample could either read or write [15].

For sociocultural reasons which will not be discussed in any detail here, it was not possible to match Ss for age and sex. But since our pilot studies confirmed other findings that there were no effects for sex in the various measures employed, this is not of critical importance for our thesis.

C. Experiments

1. Tasks

The purpose of this section is not to give a full description of the individual experiments included in the present study. As stated in the introduction of this chapter, different experiments had different designs and as such will be dealt with in subsequent individual chapters. Instead, this section will describe in broad terms the rationale for including the type of tasks this study uses as well as the order of administration.

For the rationale behind the general design of this study, it is necessary to reiterate a major criticism we made when we reviewed the relevant literature. With the possible exception of Hakes (1980), and Saywitz and Wilkinson (1982), metalinguistic research has typically employed one level of linguistic activity to assess performance in children. But it is extremely difficult to draw conclusions from results yielded by one or even two measures, however well selected or exemplary, and make claims about general awareness of language. Furthermore, it remains unclear, as Hakes (1980) correctly observes, whether all the various metalinguistic abilities are manifestations of a single underlying developmental change or whether they are a set of independent developments which, by some coincidence, all happen to occur during the same developmental period. Stated another way, it is an empirical question whether metalinguistic awareness can be conceptualized as either multidimensional or unitary in nature. When we consider, for example, that judgment of acceptability is a very different type of metalinguistic knowledge than, say, syllable identification, and that identification of initial segments is similar to identification of initial syllables, we can appreciate this distinction (see Saywitz and Wilkinson (1982), p 239-40).

What is needed is a systematic comprehensive assessment of metalinguistic abilities with more than one type of linguistic measure for the same population. Such an approach will allow comparisons across the various tasks and thus, the relation among linguistic features in the development of metalinguistic abilities can be investigated. This will, among other things, demonstrate whether the proposed tasks to assess metalinguistic abilities are sensitive measures. Furthermore, although we know that the experiments tap very different linguistic features, it would be interesting to know whether they interact in a similar fashion with either age or literacy.

The tasks in the present study were designed to meet the above considerations. A total of eight experiments (three of which with subtasks) make up the present study. These were administered in a set order according to possible task difficulty as indicated by our pilot studies [16]. The order of administration was as follows:

1.	Word Segmentation	(WRD SEG)
2.	Initial Syllable Indentification	(INIT SYL)
3.	Initial Segment Identification	(INIT SEG)
4.	Final Syllable Identification	(FINL SYL)
5.	Final Segment Identification	(FINL SEG)
6a.	Syllable Resequencing: Recognition	(SYL REC)
6b.	Syllable Resequencing: Production	(SYL PRO)
7a.	Acceptability Judgment	(JUDG)
7b	Correction of Error	(COR)
7c.	Location of Error	(LOC)
7d	Explanation of Error	(EXPL)
8a.	Segment Resequencing: Recognition	(SEG REC)
8b.	Segment Resequencing: Production	(SEG PRO) [17]

Because much of the reasoning about the data involves arguing from the results of one experiment to another, we have incorporated a number of experiments into one large study. Thus, for convenience of analysis we will not, when we discuss these experiments, follow the order in which they were administered. Rather, we group them into the following sets which reflect linguistic units rather than tasks:

1. WRD SEG (chapter 3)
2. INIT SYL; FINL SYL; SYL REC; SYL PRO (chapter 4)
3. INIT SEG; FINL SEG; SEG REC; SEG PRO (chapter 5)

2. Procedures

2.1 Testing Environment and Data Collection

Prior to collecting data for the present study [18], pilot studies were conducted to determine the suitability of the materials and to identify any procedural difficulties. These were carried out as a series of trials of the techniques and materials which were subsequently revised and refined.

All schooled children who participated in the study had attended school for approximately seven to eight months when they were first tested. School commences in mid-September and lasts for approximately nine months each year. While all schooled children were tested before the end of the school year (April through June), most illiterate children and all adults were tested during the summer and part of the autumn (June - October).

The place of testing was usually an unused classroom in their school for the schooled children and in the University for most of the literate and illiterate adults. For the illiterate children it ranged from a small storeroom appended to the one - classroom Koranic school and adapted to the purpose, to a hall in the daycare centre.

Except for some data collected under somewhat noisy conditions at the Koranic school, most of the testing was conducted under relatively standardised conditions. Data were collected from each S in a series of sessions each of which lasting between 10 and 40 minutes. The total testing time per S had an average of 60 minutes excluding pretesting, but ranged from 55 to over 90 minutes. An audio recording was made for each session. To save recording space, the pretesting (practice) sessions were not recorded. A total of 122 60-minute-cassette-tapes were available for transcription.

During the sessions, contextual information was noted down as part of the written record. An attempt was made to monitor any interesting behaviour shown by Ss attempting to respond to tests.

2.2 Method of Administration

All Ss were tested individually and always by the same experimenter (E) - the author himself - who is a male native speaker of Moroccan Arabic. Child S and E were always seated side by side at a table. No systematic seating was observed with adult Ss. All children were rewarded after each session.

In general, although items and instructions were more geared to appeal to the children, the procedures for the two age groups (children and adults) were as similar as possible. Some necessary but slight modifications which were made for the adults will be noted when we deal with the individual experiments. They concern mainly specific task techniques.

All stimuli were presented and responded to orally. Furthermore, all instructions were given in Moroccan Arabic. At no time was Standard Arabic (ie written variety used in schools) used by E. Verbal reinforcement to encourage Ss to respond was given at various phases of the test, but at no point were Ss given feedback regarding their correct or incorrect responses. If S was unable to respond or clearly misunderstood, items were repeated. If no responses were obtained, E continued with the next item until all stimuli were completed. With the exception of some Ss who were absent during planned test sessions, all Ss completed one experiment before proceeding to another. Prior to presentation of the experimental stimuli, E explained the procedures and familiarised Ss with task. Practice trials used in individual experiments are described with those experiments.

It is a feature of this study that the same Ss participated in all experiments. No criterial trials were set as in previous research (eg Liberman et al, 1977). Thus no S was discarded who did not perform adequately on any one task [19]. Furthermore, no missing data were replaced. One of our aims was to perform intercorrelations among tasks within Ss to compare Age x Literacy groups on their performance within each task. This, we believe, is a methodological advantage over previous research in which both Ss and tasks have differed across studies. As a consequence of that it is impossible to know whether apparent discrepancies in results were due to differences in characteristics of Ss or to the attributes assessed by the different tasks.

D. Analysis: Evaluation of Data

1. Scoring Procedures

All protocols were transcribed and scored by the author who also conducted all the experiments [20]. For the purpose of qualitative analysis, all errors were noted. Since our pilot studies confirmed other findings that there were no main effects for gender in the various measures employed, the scores for both males and females were combined. Each S was assigned scores representing the mean percentage of correct responses [21]. No missing data were replaced in any of the experiments.

2. Statistical Analysis

In this section we describe the statistical techniques which were employed to analyse the data as well as the rationale behind choosing these measures. Only the main statistical techniques will be reported on here. These are (a) Analysis of Variance (ANOVA), (b) Post-hoc comparisons and (c) Correlations.

2.1 ANOVA

To determine whether responses demonstrated significant differences (variance) with regard to types of Ss and types of stimuli, ANOVA was chosen as the appropriate statistic.
One advantage of using ANOVA as compared to multiple independent significance tests, is that the former takes all factors into account simultaneously [22]. An ANOVA will indicate whether some difference among means in a logical grouping of means is significant. To do this, it uses the F-ratio statistic, the ratio between variance attributable to the levels of one factor and a suitable estimate of error or inter-subject variance. An ANOVA has the added advantage of showing interactions between factors, which may not otherwise be apparent with multiple independent tests. Interaction effects are those attributable to the combination of two or three factors (eg Age x Literacy). These effects cannot be predicted from our knowledge of the main effect. If an interaction factor (A x B) is significant, then we must qualify any claims we make about the main effects that enter into that interaction. In other words, an interaction effect washes out the main effect.

2.1.1 ANOVA Design by S (F_1)

An ANOVA design by Ss which yields F-values conventionally labelled as 'F_1' simply indicates what should happen if the same stimuli in an experiment were administered to a new sample of Ss. For example, if F_1 is significant, we should expect the same significant effects if an identical test were given to new Ss. To state the matter another way, an ANOVA design by Ss (F_1) permits us to generalise conclusions from our sample to the population of Ss, ie the effect should replicate on a new unbiased sample of Ss.

Results of an experiment using a set of stimuli chosen from a larger group of possible stimuli must be generalisable to that larger set, and not just to the specific examples that were employed in the experiment. However, as Coleman (1964) and recently Clark (1973) have pointed out, an ANOVA design by Ss (F_1) does not permit us to generalise conclusions to the population of stimuli [23] (also see Barton, 1975). An experiment whose results are analysed by a design which treats linguistic units as levels of a fixed effect does not allow us to generalise our findings even to the population defined by our nonrandom sampling procedure. Stimuli must be considered a random factor because the particular stimuli chosen for an experiment can only be a small subset of all the words in a language [24]. This failure to treat stimuli as random effects has been dubbed the "language-as-fixed-effect-fallacy" (Clark, 1973). For our findings to be generalisable beyond the specific sample of materials used in the experiment itself (ie generalisable to a new sample of stimuli), it is necessary that we perform an ANOVA by materials. Furthermore, when the variance attributable to stimuli is ignored or treated only as a fixed effect, it would lead to erroneous conclusions. The contribution of variance due to language may be the reason for an obtained significant result.

2.1.2 ANOVA Design by Materials (F_2)

As we stated earlier, an ANOVA design by Ss allows us to generalise our findings to a new sample of Ss. For our findings to be generalisable to a new sample of stimuli, we need to perform a second ANOVA by materials. This yields measures labelled F_2. What F_2 indicates is simply what should happen if new stimuli were administered to an identical sample of Ss. Again, as with F_1, if F_2 is significant, we should expect the same effects to be significant and the results to replicate given a new set of stimuli and an identical sample of Ss.

Further, in a pair of ANOVAs, one by Ss (F_1 statistic) and another by stimuli (F_2 statistic), each has a chance to be treated as a random effect, but one at a time. To see what would happen if both Ss and stimuli change, we calculate a quasi F-ration or F' (see formula in Clark, 1973).

2.1.3 Quasi F-ratio (min F')

The smallest value F' could have is what is labelled min F' (Clark, 1973). What this measure indicates, if significant, is that the obtained result can be generalisable to a new sample of Ss and a new set of stimuli at the same time. Put another way, min F' shows what should happen if a new sample of stimuli were given to a new sample of Ss. If min F' is significant, the same effect should replicate on the new sample of both Ss and materials. If, on the other hand, it is not significant while both F_1 and F_2 are, replications on new Ss and new stimuli is not predicted. Moreover, if either F_1 or F_2 is not significant, min F' will not be significant. (Note that min F' should be smaller than either F_1 or F_2 whichever is smaller). This agrees with our intuitions about F' since it indicates what should happen both with new Ss and new stimuli.

To meet Clark's (1973) criticism and thus avoid committing the "language-as-fixed-effect-fallacy", the present study treated both Ss and stimuli as random effects. In general, unless otherwise stated, separate ANOVA designs by Ss were treated as a random effect while stimuli were held fixed; in a second analysis (F_2 statistic) Ss were held fixed while stimuli were treated as a random effect. These analyses, were then combined so that min F' ratios could be computed.

In an effort to increase sensitivity in the experiments, materials were designed to allow an assessment of the generalisability of results across stimuli as well as across Ss. Thus, for example, in most of the experiments used in the study, half of the Ss received one list of items, and half received another list. (See methodology section under each experiment). Furthermore, since we were interested in the difference between Ss and between stimuli, the number of Ss receiving any one list of items was more or less equal to the number of items on that list. As Clark (1973) observes, in a design where there are 56 Ss (ie sensitive as a subdesign by Ss), but only eight items (insensitive), F_1 might be reliable, but F_2 might not: it needs to be larger to be significant.

The means of the raw numbers of correct responses were expressed in percentages and tested to determine whether the responses demonstrated significant effects when compared to either inter-subject or inter-stimulus effects.

2.1.4 Statistical Significance

To end this discussion of ANOVA designs, a note on the meaning of statistical significance is in order. A difference in the mean values of two variables may or may not be statistically significant. A statistically significant difference is greater than what would be expected by chance fluctuation in the means in all but a small percentage of cases. If the difference is not significant, the difference between means of variables is not greater than might often be expected by chance. Chance is the variation in the results that are due to uncontrolled factors such as guessing, experimental error, failure to achieve a perfect matching of Ss in each treatment group and so on, but not any substantial difference in the tasks. Put simply, a difference between means of scores obtained in two tasks is significant at, say, $p < .01$ if there is a small chance, here one chance in a hundred, that it might be found in two samples of scores on the same task by chance alone. If one difference is not statistically significant, it means that we are not justified in concluding that one of the two tasks was genuinely more difficult than the other.

2.2 Post-Hoc Comparisons

If an ANOVA yields a significant F-ratio, we still need to know precisely where the differences occur (ie whether they are where we believe them to be).

To determine which differences between pairs of means are significant and therefore responsible for the significant F-ratios, pairwise comparison of groups with respect to total responses were performed when appropriate. To this end, we used Scheffé tests.

A Scheffé (1953) test is a post-hoc test for differences between means. It is used only when an ANOVA has already shown an effect in a logical grouping of means: ie a significant F-ratio. The combination of an ANOVA and a Scheffé test permits us to determine exactly whether the levels of one independent variable (eg literacy) differ in how they influence performance on the dependent variable (eg the ability to identify initial segments).

Scheffé tests were chosen here because they are the most conservative of all the <u>a-posteriori</u> tests listed by Winer (1971) in the sense that there is less chance of being wrong in claiming significant differences in the comparison. They set quite high critical values for differences to be judged significant and are likely to err principally by missing some of the differences that actually were significant.

The present study used the Scheffé procedure whenever a significant interaction was discovered to determine the exact nature of the differences. In computing these tests, and following Winer (1971), we used the harmonic means of cell sizes in place of the actual and difference cell sizes [25]. Finally, since Scheffé tests are the most conservative of all tests, the significance level of all individual comparisons was set at .05 alpha level, unless otherwise stated.

2.3 Correlations

2.3.1 Pearson Product Moment Correlations

To disentangle the relationship between chronological age and literacy level, Pearson Product Moment Correlations were employed for the child data set. No correlation procedures were performed in previous research because in most studies school grade and age correlated perfectly; nor were correlation procedures used to test the relationships among various tasks within the same Ss simply because, in general, these studies used only one task within the same group of Ss.

In the present study, correlational procedures were employed to determine the direction and strength of the relationship between variables of interest (eg Age and Task score; Literacy Level and Task score; Grade and Age). One difficulty inherent in correlational analysis is that the existence of a correlational relationship between variables does not necessarily imply a cause and effect connection between them. Rather, it attests only to an association and may or may not furnish clues to the causes. A result with a correlation coefficient such as r = .7, if taken at face value, may not have a simple explanation. It indicates fairly substantial correlation between two variables, but this may be due not to any direct relationship between the two. Instead, both may be reflecting some third variable.

2.3.2 Partial Correlation Technique

To give an example from the present study, a correlation between Grade level and Task score on one task was found to be r = .77, that between Grade and Age was r = .68 and that between Age and Task score was r = .66. All the correlations were reliable at the .01 level. However, when Age was nullified (or partialled out) from the first correlation, that is to say when age was statistically controlled for, the r Grade x Task score . Age remained almost unchanged at .66. When Grade was partialled out of the Age x Task score correlation, however, a different picture emerged: r Age x Task . Grade = .29. Thus, Grade and Task score are fairly substantially related which Age and Task are not. The use of the Partial Correlation technique (the formula is found in Guilford and Fruchter, 1978) which enables us to see these 'true' relationships without fractioning data into homogeneous age or grade groups is indispensable in the present study.

Thus, a partial correlation between two variables is one that statistically controls for the effects of a third, fourth, etc, variable that might be working indirectly to inflate the relationship between the two variables being correlated. It is a conservative analysis.

In determining the level of significance, a one-tailed t-test was applied. Understandably, partial correlation techniques were used only when the correlation matrix produced non-negligible indexes, that is only when the tolerance was large. Tolerance refers to the magnitude of the contribution of the variables present. If the tolerance is low (close to zero), it means that the variable is not going to contribute much. The larger the tolerance, the greater the effect of the variable being entered into the equation.

2.3.4 Intercorrelations Among Tasks

In order to determine the extent of the relationship of experiments to each other, to age and to literacy, intercorrelations among the various tasks used in the study were performed. Specifically, our aim was to find out whether scores obtained by Ss on pairs of experiments correlated positively and substantially, thus suggesting that similar or similarly developing metalinguistic abilities were being measured (ie that these metalinguistic abilities were not unrelated skills). Stated another way, intercorrelations would indicate whether a substantial amount of variance in performance on each one of the tasks was variance common to all tasks (ie whether there was some common source underlying performance on the various tasks). In sum, the resulting data should put us in a position to answer the question of whether metalinguistic awareness can be conceptualised as multidimensional or unitary in nature.

2.4 Statistical Package

The statistical package selected for the present study was BMDP. Since all the designs were unbalanced, (ie there were unequal numbers of Ss in Age x Literacy cells), [see footnote 25], an unequal cell-size ANOVA programme (P2V) was employed. This programme follows the recommendations of Speed and Hocking (1976) and utilizes a non-sequential procedure for analysing designs with unequal n's. A second programme, P2R, was used for correlations and partial correlations.

3. Qualitative Analysis

A fairly large proportion of research in psycholinguistics concentrates on quantitative and only marginally on qualitative analyses. Typically, reports of experiments are not always detailed enough to allow one to decide whether factors other than those reported have had an effect on the data. Items used in experiments and response error patterns are not always reported, let alone discussed. The area of metalinguistics is no exception.

To give an example, it has been suggested that segments are harder to identify than syllables. This assertion may be correct, but not adequate. It provides only a partial confirmation to the hypothesis that Ss are less aware of segments than they are of syllables. It says virtually nothing about whether this might be due to a problem of internal structure of either syllables or segments. After all, we are interested in both the cognitive and the linguistic variables. If it is granted that for awareness to occur there must be some factors within Ss, it should also be acknowledged that there must be some factors within language which are responsible for the data obtained.

Quantitative measures as Hymes (1979) observes, cannot, in principle, capture the qualitative relationship that underlie certain phenomena. This qualitative view has recently been recognised as necessary. Thus, Bialystok (1978) contends that rather than simply asking "how often does the learner produce the correct form?", the question must be formulated as "under what circumstances does the learner produce the correct form?", the assumption being that S's performance in one situation does not necessarily indicate the same performance in different situations.

To return to research in metalinguistics, quantitative notions of metalinguistic awareness which assess a single dimension performance have limited power in reflecting S's ability with linguistic awareness. Performance in one task does not necessarily reflect performance in a different task. In this case, the linguistic items which result in such differences need to be examined. It should be pointed out here that more often than not, the rationale for choosing a particular linguistic stimulus remains unclear in previous research.

One way to remedy to this situation is to perform a qualitative analysis of errors in order to discover what factors within stimuli are responsible for the obtained data. Furthermore, such analyses would be very revealing in that they would yield significant information about the internal structure of stimuli as well as provide insights into processing strategies employed by various Ss in dealing with the task at hand.

In order not to commit the 'medicine bottle' approach (to borrow an analogy made in Pratt and Grieve (1980)) which states that the difference between adults and children is in terms of quantity and not quality [26], a thorough analysis of errors was performed. To this end, all erroneous responses were noted verbatim during transcription and subsequently examined. Following Kahneman and Tversky (1982), we found it useful to distinguish between positive and negative accounts of errors. Briefly, a positive analysis focuses on the factors that produced a particular erroneous response, whereas a negative analysis explains why the correct response was not made.

For example, the positive analysis of a child's failure in a Piagetian conservation task attempts to specify the factors that determine the child's response, eg the relative height or surface area of the two containers. A negative analysis of the same behaviour would focus on the obstacles that make it difficult for the child to acquire and understand the conservation of volume. Thus, positive analyses are concerned with the heuristics people use to make judgments. Negative analyses are concerned with the difficulties of understanding and applying elementary rules.

III Summary and Conclusion

The guiding principle for the present work has been to determine how much of what is considered normal cognitive development is in fact an age-bound maturational phenomenon, or to what extent it reflects the result of experiences associated with the degree and extent of literacy.

Throughout this chapter, we have attempted to show that previous research has confounded such theoretically important variables as age, literacy and peculiarities of the native language.

The aim of the methodology employed in this study and described in the present chapter was to deconfound such variables and add more insight as to the nature of metalinguistic abilities.

First, by employing literate and illiterate children and adults, the design optimizes the likelihood of tapping a precise relationship between maturation, literacy and metalinguistic awareness.

Second, by using native speakers of Arabic, the general design offers the opportunity to add insight from yet another language typologically different from English in which most previous research was conducted.

Third, by employing more than one type of linguistic measure for the same population, the design hopes to answer one empirical question, namely, whether metalinguistic awareness can be conceptualised as either multidimensional or unitary in nature.

The resulting data should, furthermore, put us in a position to answer the following research questions:

(1) What is the role of literacy in shaping our conception of language? In particular, in what way does indoctrination into a particular writing system alter our conception of language?

(2) The above question centres on an even more fundamental issue, that is, whether or not written language influences awareness of spoken language.

FOOTNOTES

1. There is only one intake each year, in September.

2. A traditional school of Koranic scholarship where the main learning was memorizing parts of the Koran.

3. In principle only. In practice, many of them are more like daycare centres where children of varied ages gather.

4. Diglossia is usually defined as the co-existence of two distinct varieties of a language which are maintained side by side throughout the speech community with each one of them being assigned a definite social function. Typically, in addition to dialectal and standardized forms of a language, there exists a divergent and highly codified form used for most writing and formal speech.

5. El-Hassan (1977), for example, rejects the term 'diglossia' as unsatisfactory and argues that colloquial and standard Arabic are neither discrete, nor homogeneous, but constitute a continuum and are characterized by gradation and variation. Ibrahim (1983) makes the point that the above conclusion is valid only because the data on which it is based are taken from a large corpus of the speech of educated (ie highly literate) Arabic speakers. According to him, the conclusion arrived at by El-Hassan cannot be valid for illiterate speakers "since the primary reason for El-Hassan's observations about spoken and standard Arabic as used by educated speakers of Arabic is the heavy admixture of various linguistic elements from standard Arabic in spoken Arabic. For non-literate speakers, however, no such option is available, and therefore, only diglossia in the classic sense obtains for them" (p 509).

6. However, as a result of experimenter oversight due to the tribulations of conducting research with children, only 117 Ss completed all the tasks.

7. Our criteria were mainly based on neighbourhood and occupation. Aware of the fact that differences between literate and illiterate adults may not always be easy to isolate because the advent of literacy is usually accompanied by other social changes, we tried as much as we possibly could to equate samples on socioeconomic background.

8. Our failure to obtain better results for bilinguals in our pilot studies may be due to the following reasons: (a) only a very small number of bilinguals was used; (b) the types of tasks employed in our pilot studies were different from those used by either Ianco-Worall (1972), Ben-Zeev (1977) or Wetstone (1977); (c) while our pilot studies employed bilinguals who acquired both their languages

at home, the above studies used bilinguals whose second language was acquired at school.

9. Pilot studies indicated that the youngest age at which children of average attainment could cope with the sort of instructions used in the present study was between 4;6 and 5.

10. Although children older than 8;6 (the oldest we have used) were available from both literacy groups, the literate ones would have been drawn from third grade where instruction in a foreign language (French) is introduced. All ages of both schooled and unschooled children were determined by documents made available by the school or the parents.

11. The orthography of Arabic has two forms of spelling, vowelised (ie fully marked) and unvowelised. In the unvowelised form which is the more traditional and the more widely used, letters carry mostly consonantal information, whereas most vowels are generally not directly expressed by any letters or diacritical marks. For more details, see Chapter 6.

12. The occupational groups most strongly represented by the families of the children were craftsmen, small shopkeepers, soldiers and some clerical workers.

13. An important remark to be made here is that the variation in years of schooling is mainly due to the fact that there is no minimum age at which Moroccan children may discontinue their school education and many drop out of school by the fifth grade after failing their secondary school entrance examination.

14. Most Ss were part of the ancilliary staff, mainly composed of servitors and cleaners at the Faculty of Arts, Mohammed V University in Rabat. All were urban and none of them was handicapped mentally or in any other way which may have prevented him from being schooled. In other words, they were perfectly normal illiterates.

15. Some, however, were numerate in the sense of being able to decipher numbers but not in the sense of being capable of performing in writing such basic operations as substration or multiplication of large numbers. Those who were able to name the letters of the alphabet were unable to either write or decipher them. In general, neither those who were numerate, nor those who could painfully sign their names reached any criterion set for literacy (by UNESCO, for example) or even subliteracy.

16. A further constraint was that no two tasks tapping the same linguistic unit be given consecutively except when the same experiment uses a Recognition and a Production condition (see Experiments 4 (Chapter 4) and 7 (Chapter 5)).

17. Experiment 7 (a, b, c and d) is not reported in this theseis.

18. Written permission to carry out research and test the schooled children in the schools during school hours was obtained from the Rabat Education Board. No written permission was necessary for the two preliterate institutions.

19. We shall not, at this point, discuss the consequences of this methodological procedure such as the low percentage scores obtained by some Ss (see relevant experiments), except to note that many previous studies discarded Ss who did not perform adequately according to a set criterion. This may explain the relatively high scores obtained in some of these studies as Ss were almost selected.

20. Should there exist any bias in transcription or scoring, it should be the same across all Ss.

21. Scores representing the number of correct responses were converted to percentages to allow for cross-experiment comparisons.

22. If a standard statistical test is significant at the $p = .05$ level, it can be claimed that such a result is due to chance about one time in 20. The problem, however, is that with more than a single comparison, multiple independent tests will yield true significance levels much less stringent than .05. Therefore, if a significant result is found, it can in no way be claimed that such a result was not due to chance.

    One solution to this problem is to run independent replication studies of only those effects that are significant. A second and much better solution is to perform an ANOVA which takes all factors into account, simultaneously.

23. Coleman (1964) and later Clark (1973) have criticized psychological and psycholinguistic research for failing to perform appropriate analyses that would allow generalisations beyond the language sample used. In metalinguistic research, those studies which have used ANOVA as the appropriate statistic have not gone beyond reporting F_1 (design by Ss). The results of these studies are, therefore, known to be generalisable only to new sets of Ss, not to new materials. In other studies, findings over Ss and materials have been reported separately, but without min F'. This is inadequate, since F_1 and F_2 can both be significant while F' remains nonsignificant (see below).

24. If we are studying differences between nouns and verbs, we typically want to generalise to all nouns and verbs in the language, not just the sample used in our experiment. Furthermore, by failing to consider the variance attributable to stimuli, artifactual results can be obtained.

25. It will be recalled that the study used 36 literate children, 36

illiterate children, 24 literate adults and 24 illiterate adults.

26. The instructions on the label of a medicine bottle state "children 1 - 2 spoonful; adults 2 - 4 spoonful". That is, the content is the same, but the quantity differs.

CHAPTER THREE

I Introduction

As we have had occasion to point out in Chapter 1, awareness of the concept 'word' has been viewed by some researchers as consisting of at least three aspects, namely (i) awareness of the arbitrary nature of the word (eg Piaget, 1929; Cole and Scribner, 1981); (ii) comprehension of the metalinguistic label "word" (eg Berthoud-Papandropoulou, 1980) and (iii) awareness of the word as a unit of language (eg Hamilton and Barton, 1980, 1983; Bowey and Tunmer, 1983).

On the basis of data from child Ss, it has also been suggested (Bowey and Tunmer, 1983) that aspects involved in a fully developed word awareness may develop relatively independently.

In the present chapter, which extends some previous research, we are concerned mainly with the extent to which literate and illiterate children and adults can demonstrate their ability to attend selectively to and analyse spoken sequences into their constituent words, and only secondarily with their knowledge of the metalinguistic term 'word'.

The present experiment seeks to clarify the relationship of Age and Literacy to metalinguistic awareness and to determine the factors (cognitive, linguistic or otherwise) which may affect Ss' segmental analysis ability. Specifically, and as detailed below (see Design), the experiment was designed to:

(1) examine the differences, if any, between literate and nonliterate adults and children in the strategies adopted for deciding what segments of the aural stream count as words. Previous studies had put forth a developmental hypothesis based on data from children only.

(2) assess the influence of knowledge of print conventions on literate _Ss_' performance. Awareness of such linguistic units as words may be heightened by the orthographic convention which tends to mark off boundaries in spaces.

(3) determine whether certain target words are more available than others. For reasons explained below (see next section) it was hypothesised that function words (functors) might be less available to _Ss_' awareness than content-words (contentives).

(4) test the hypothesis that the length of the sentence stimuli might have an influence on _Ss_' performance when attention is allocated to segmentation processing. Sentence length had been suspected to influence performance of child _Ss_' (eg Ehri, 1975) but has not been systematically investigated.

Before we report on the experimental work, however, in the section below we briefly examine the status of the concept 'word' in general linguistic and psycholinguistic theorizing. In particular, we shall focus on the distinction which has been suggested to exist between contentives and functors and the fruitfulness of such a distinction in exploring word awareness.

II The Status of the Word

A. In General Linguistic Theory

In traditional linguistic studies, the 'word' has been such a vantage point that its existence as a frame of reference has been taken for granted. Its relative independence as a self-evident unit has been recognised in that word-boundaries are clearly indicated in most writing systems. Likewise, in the layman's understanding of language, the 'word' seems to be the prime unit of language. Most languages, for example, have a term for the concept of word, but no non-technical term for morph(eme) [1].

Considering the vast progress of linguistics during the last four decades, however, the study of 'word' remains much neglected. If many linguists still regard the word as a unit of language, they do not all agree how it should be defined (see Kramsky, 1969). A satisfactory universal definition or a full-proof method of identification is yet to emerge [2]. According to Matthews (1974), one reason for this is that since there are languages which do not have words, it has not been seen legitimate to propose a theory of language in which the notion of word would be included as an obligatory feature. Chomsky, for one, has clearly seen this argument in rejecting the word as a 'level' and consequently denying a discipline of word-formation (but see Aronoff, 1976) [3]. Paradoxically, and as Cohen (1980) also notes, while work in generative phonology, for example, is at pains to deal with words in a more abstract fashion as strings between two double hatched crosses, orthodox approaches to phonetics have continued to consider the word as the frame within which the phonetic transcriptions could take place. The so-called phonetic alphabet presupposes the analysis of larger wholes into words. Furthermore, words are generally considered to be basic units in the teaching of reading. By and large, the technical terms used in reading acquisition are 'word attack', 'word segmentation', and 'word recognition'. Likewise, in orthography, words are the most prominent items either separated from each other by word space as in most European languages or other devices as in Hindi or indeed Arabic [4].

B. In Psycholinguistic Theory

Psychologists with an interest in language have for decades been working with words as basic units in their experiments. With psycholinguists, especially in the area of automatic speech recognition, a renewed look at the word as a possible unit of processing has become relevant (eg Massaro, 1975; Noteboom, 1981; Marslen-Wilson and Welsh, 1978; Cole and Jakimik, 1980; Osgood and Hoosain, 1974).

One of the most challenging problems in the study of speech perception is to explain how discrete percepts are derived from a continuous speech signal. Apparently, when we listen to fluent speech, we usually hear an ordered sequence of words. There is an abundance of evidence, however, that word boundaries are often unmarked in natural continuous speech. Examination of sound spectograms of fluent speech reveals that the belief that words are separated by brief periods of silence is false (Klatt and Stevens, 1973; Reddy, 1976). That word boundaries are often absent is revealed by the change of pronunciation of certain words over time. For example, in English, the word 'apron' was originally pronounced 'napron' and 'orange' was pronounced 'norange'!

In those psycholinguistic studies which utilize the word as a basic unit in speech perception tasks, an effort is made to show that the word can mediate between the acoustic input and the overall linguistic knowledge which listeners will of necessity have to bring to bear in order to understand the incoming speech. Thus, in monitoring tasks (eg Foss and Swinney, 1973) it was found that Ss responded more readily to word targets than to syllable or phoneme targets, all occurring in a list of two-syllable words. Monitoring tasks have indicated that words seem to mediate phoneme recognition, rather than the other way round. In similar experiments, Ss' reaction time was shown to be faster in phoneme identification tasks when the target phoneme occurred in a real word as compared to a non-word (Ganong, 1978).

The importance of the word as a unit of perception of language has also been pointed out by Osgood (1980) and Osgood and Hoosain (1974) who tested the "salience" [5] of the word versus that of the morpheme. The authors report experiments in which both guessing and recognition thresholds for words are compared with those for other linguistic units both smaller (non-word morpheme) and larger (nominal compound, ordinary noun phrases, and nonsense compounds) than the word [6]. On the whole, their findings are interpretable as supporting the general conclusion

(1) that words and nominal compounds (eg 'stumbling block') [7] but neither non-word morphemes nor ordinary two-word compounds maximize the criterion of redundancy as Gestalt-like "wholes" in perceptual experiences; (2) that the perception of words and nominal compounds, but not non-word morphemes, is facilitated by distinctive feedback from the representational (meaning) level. Put another way, the more word-like a language unit, the higher will be its perceptual salience under tachistopic conditions. In sum, the word seems to be a psychologically salient unit, with more integrity than the morpheme or the phrase.

How words are stored in the mental lexicon is another debatable issue which highlights the importance of the word as a psycholinguistic unit. On the one hand, it has been suggested (Chomsky, 1970) that words are stored in their base forms along with a set of instructions for generating derived forms; on the other hand, it has been suggested (Manelis and Tharp, 1977) that every word is stored in a whole form complete with all features. The advantage of the first suggestion is that it simplifies storage, whereas the second suggestion would simplify processing.

The area of speech errors (Fromkin, 1973, 1980; Noteboom, 1979; Cutler, 1982; Garrett and Kean, 1980) also provides a good testing ground for the role of words in speech processing. In monitoring one's own output in ordinary speech communication, speakers are prone to correct errors they may make before going on to the next word.

According to Noteboom (1979), it does not seem implausible to assume that a speaker, monitoring his own speech output, checks it on a word basis or a word-like basis. Bond and Garnes (1979) found that 18% of the misperceptions in their corpus involved the incorrect assignment of a word-boundary. Examples are 'four-term analogy' perceived as 'four terminology' and 'cocoanut Danish' perceived as 'coke and Danish'.

In language acquisition, the existence of a one-word stage is accepted without question by most researchers in the field (eg Clark and Clark, 1977; De Villiers and De Villiers, 1978). Indeed the task facing the child in segmenting the speech chain is a crucial factor in phonological development. Thus, before the child can begin to determine which phonetic features function to distinguish words, he must recover at least some meaningful units from their encoding in the wave form. Citing Slobin (1973) with approval, Wanner and Gleitman (1982) also propose that learners are biased to map each semantic idea onto the linguistic unit "word" (p 13). Generalising from facts about language acquisition in many linguistic communities, Slobin (1973) had conjectured that the child is prepared to believe that each concept has its own separate word-like representation marked by an acoustically 'salient' and 'isolable' surface expression. On this, it can be assumed, for example, that the ability that Arabic-speaking children have to inflect nouns, verbs, adjectives for number, gender indicates that they somehow know where words begin and where they end.

On the basis of a variety of descriptive facts about language acquisition, Wanner and Gleitman (1982) conjecture that those "isolable" acoustically salient properties are "an abstract characterisation of the sound wave whose surface manifestation in English (and other stress languages) is stressed syllable" (p 17— emphasis in text). The authors propose that while the child is able to analyse stressed syllables reasonably well, he is less successful in reordering the unstressed syllables and in segmenting the speech chain into words on the basis of these. Wanner and Gleitman support their proposal by pointing out the existence of "telegraphic speech" which is characterised by the absence of such "function words" as articles, prepositions and conjunctions which happen to be unstressed.

Of particular interest to the present experiment is the claim that acquisition of words varies with word class. As is detailed in our Design section, we also expect Ss' metalinguistic awareness of words to vary with class membership. More specifically, we expect major category items to be more available for identification than minor category items. Following Aronoff (1976) we define major category items (also content words or contentives) as those (and perhaps the only) classes of words to which new words can be added. These include nouns, verbs, adjectives and adverbs. These words are often characterised as those elements which bear reference. The minor category items (also function words or functors), in contrast, have a fixed relatively small membership containing such elements as determiners, prepositions, pronouns, quantifiers and so forth. In what follows we review some evidence from related research which suggests the fruitfulness of the contentive/functor distinction in exploring word awareness.

C. Contentives vs Functors

The distinction between contentives and functors has been shown to have highly significant effects in a fairly broad range of linguistic behaviour. However, only recently, is there evidence that the two classes may be treated differently in the human language system. For example, work on word recognition (Bradley, 1978) revealed that latencies in lexical decision made on contentives were dependent on their frequency, ie the more frequent the word the faster the decision time. This correlation did not, however, apply to functors. Garrett (1976) has argued that open and closed class items are computationally different, ie accessed by different procedures. Bradley (1977) has provided compelling evidence for Garrett's proposal in an experiment using an interference technique originally reported by Taft and Forster (1976). In their study, the authors showed that in a lexical-decision task correct rejections of non-words took longer if the item contained a true word in initial position. Thus, 'footmilge' would take longer to reject than 'cootmilge'. The interference effect arises when the irrelevant entry for 'foot' is located. Bradley's aim was to determine whether this would also occur when functors were used; that is, would '<u>less</u>ipen' take longer than 'fessipen'? Her findings revealed that interference only arises for non-words containing a contentive. Thus, the left-to-right parsing for '<u>less</u>ipen' never accesses the entry for 'less'. Bradley's evidence is sufficient to indicate at least a subdivision according to open (contentive) and closed (functors) class properties. It is clear that the search process that accesses 'foot' does not also access 'less'. So it appears that there must be two types of search, one using a small list of functors and the other using the full lexicon.

Some research on agrammatism in Broca's aphasia (eg Zurif and Blumenstein, 1978; Friederici, 1982; Kolk, 1978; Kean, 1980) is available which also appears to indicate the omission of the 'small words' (eg prepositions, articles) and inflectional endings. Content words, however, appear to be relatively spared.

Another behaviour source which provides evidence pointing to the different treatment of the two class words in the human language system inclcudes speech errors and code mixing. For example, in the MIT corpus (Garrett, 1975) of speech errors, there are virtually no errors where a content word is substituted for a function word, nor a function word for a content word. Garrett and Kean (1980) note that elements of these two classes behave quite differently in speech errors. Likewise, studies in code mixing (Sridhar and Sridhar, 1980) point out that although elements from practically every syntactic category occur in code mixing, certain types of elements are more likely to be mixed than others. Among single words, nouns outrank all others in frequency of mixing, followed by adjectives, adverbs and verbs. Functors are least likely to be mixed by themselves.

In language death (Dorian, 1978) forgetting differs across word classes, as does the historical development of writing systems. Apparently, the Aegean logographies did not represent grammatical function words and morphemes very systematically, but only the 'meaningful' substantives, verbs and so forth. Similarly, in written material intended for adults, most content words in Japanese are written in Kanji characters (logographic), whereas functors, derivational and inflectional morphemes are written in kana (Morton and Sasanuma, 1984). English spelling also reflects the distinction between the two classes. Thus, according to Vacheck, (1973) the tendency against two-letter words giving doe, toe, see, did not affect to, of, do, so, be and so on, because the early users of the English written norm unconsciously felt the difference between "formal and non-formal" words and so expressed the difference between the two categories by the "susceptibility of the former, and the non-susceptibility of the latter, to the tendency against the two-letter words".

Evidence from proof-reading studies can also be cited in support of the argument that the two categories may be perceived differently. In a study by Corcoran (1966), Ss were required to read through identical copies of prose passages marking through each letter 'e'. The marked passage were then analysed using three categories: words containing 'e' that is pronounced, words containing 'e' that is not pronounced, and the word 'the'. The analysis of the data revealed that the 'e' in the word 'the' was most likely to remain unmarked, followed by silent 'e'. The 'e' in 'the' is not a silent 'e' and should have been marked, but 'the' being a functor, it was overlooked.

Finally, developmental data are also available which suggest that the pattern of development of the two word classes may be distinctive. Brown (1973) has shown that function words are acquired in an item by item fashion over a period of lengthy developmental period. Furthermore, according to Brown, there seems to be a selective concentration of effort that the child engages in. Thus, the child seems to focus on content words during the course of stage I, and functors in stage II. This seems to suggest that children sense and respond to differences between the two word categories at a very early stage. In certain cases of linguistic isolation, functors may not emerge at all (Feldman et al, 1978). In Goldin-Meadow's own words (1983) "the closed class is fragile".

The distinction between the two word-classes also seems to be reflected in speech addressed to children by their caretakers in which functors appear to have a very low frequency when they are not omitted altogether (Phillips, 1975; Ringler, 1973). Conversely, contentives were found to be more frequent in speech to children than to adults. In Ringler's study, for example, mothers directed more content words to their 12- and 24-month-olds (55% and 61%) than to the experimenter (44% and 49%). Functors, on the other hand, were used almost twice as often to adults (25%) than to children (14%).

In sum, from the evidence reviewed above, we conclude that there are indications that some differences - psycholinguistic or otherwise - may exist which differentiate between contentives and functors. In light of this evidence, to what extent might the pattern of development for the two word-classes be also distinctive at the level of metalinguistic knowledge of word? In particular, if Ss are to recapitulate at the metalinguistic level of awareness what they went through when they were acquiring language at the level of nonconscious speech, then the suggestion could be made that metalinguistic awareness and acquisition of words may rely upon similar strategies. Some evidence is available from past research - at least for English (eg Lawler, 1976) and French (eg Papandropoulou, 1980) - which suggests that child Ss seem to follow an invariant sequence of development similar to initial language learning in that contentives seem to be more readily available than functors.

But there are other reasons why we might want to consider word-class as a possible factor underlying metalinguistic knowledge of 'word'. For example, to what extent does literacy enhance identification of (certain) function words? It is reasonable to suggest that for those speakers whose native languages employ a script which indicates breaks between words, becoming literate may influence their knowledge of what a spoken word is. In this regard, an investigation of illiterate speakers as in the present study, would be revealing.

To conclude, the evidence reviewed to this point demonstrates that although a satisfactory definition of the word as a linguistic unit is yet to emerge, the notion seems sufficiently available to native speakers. Additionally, several lines of evidence were shown to exist which suggest the fruitfulness of the contentive/functor distinction in exploring word awareness.

III Experiment 1

A. Method

1. Materials and Design

Thirty six experimental sentences of varying length and morphosyntactic complexity were constructed such that there were two sets (A and B) each containing 18 stimuli. Half the Ss in each sample received one set, and the other the second set. Stimuli were randomised with respect to the number of words in each sentence and each set was presented in a single random order of all Ss.

The test items varied in overall structure but with all exhibiting active, declarative, interrogative syntactic frames. Of these items, approximately two-thirds were content words, and one third were function words (see below). A complete list is to be found in Appendix A. In addition to the test stimuli, a common set of warm-up sentences began each set.

To gain more appreciation of the factors that might affect Ss' ability to attend selectively to and analyse spoken sequences into their constituent words, the materials employed were constructed to vary the following factors:

(i) the length of sentence stimuli which ranged from 3 to 7 words (Mean 4.7). This design was based on the assumption that Length of stimuli might have an influence on Ss' performance when attention is allocated to segmentation processing. That is, we assume that when faced with the task of simultaneously recalling sentences and identifying their constituent words, Ss' cognitive load involved in memorizing stimuli could be so great that sufficient attention could not be allocated to segmentation (see Lundberg, 1978) [8]. Sentence length has been suspected to influence performance of child Ss (Ehri, 1975, 1979) but has not been systematically investigated (but see Tunmer and Bowey, 1980). There is some indication (Hamilton and Barton, 1980) that basic level adult literates tended to forget significantly more often than high level adult literates when they were requested to give a sentence one word at a time.

(ii) the length of the target word in each stimulus sentence ranged from 4 to 12 syllables (Mean 7.3). This would allow us to determine whether Ss would respond to syllables rather than to words. Longer targets are more likely to be polymorphemic/polysyllabic and Ss might tend to split them according to morph or to syllable. At least one study (Johns, 1979) reports that there is a tendency for children between the ages of 6;6 and 8;10 to exclude long words from their concept of a spoken word [9]. Additionally, a study by Kintsch (1972) revealed that in list recall, there was a significant correlation between length in syllables and recall errors.

(iii) the type of word class, ie whether targets were content words (contentives) or function words (functors). Contentives included nouns, verbs, adjectives and adverbs whereas functors included such items as prepositions, conjunction markers, quantifiers, intensifiers, demonstrators and pronouns [10]. Furthermore, and in order to test the hypothesis that the availability of a given functor may not be merely as a function of its class membership but also of its functional role in an utterance, we have included some functors in different contexts. The hypothesis is based on some research on aphasic patients (Zurif et al, 1976; Friederici, 1982). In an experiment which was designed to tap Broca's asphasics' grammatical judgments', Zurif and colleagues used such sentences as 'The ball was hit to John', 'The ball was hit by John' and 'She likes to eat candy' in which the items 'by' and 'to' are assigned different roles. The results revealed that Ss were able to recognise the strong links between to and John and by and John, though not between to and eat where 'to' has a conventionalised grammatical function (infinitival complementizer) but no directional significance. For our purposes, the category of prepositions, whose members bear syntactic as well as semantic information (see Lentzer, 1977) seems to be appropriate linguistic material for this enterprise [11]. For example, in English some forms can be used as a preposition which bear at least some semantic information (eg 'He returned from [+ direction] school' and 'They are open from [+ temporal] nine to six'). Furthermore, the same form can also be used as an obligatory preposition that is lexically dependent on the precedent verb, ie the verb is subcategorised for a particular preposition. How will literate and illiterate children and adults approach items such as these in a metalinguistic task which requires them to deploy their knowledge of the concept of 'word' by analysing (segmenting) spoken sequences into their constituent words? Similarly, how will they deal with sequences like 'John and Mary', 'We greeted him and left', and 'Peter likes football and Mary netball' which display different uses of the conjunction marker 'and'? These are some of the questions we intend to pursue in our qualitative analysis of the data.

2. Procedure

The procedure employed in the present experiment involved requiring Ss to listen to meaningful spoken sentences, to repeat them and to segment them into their constituent words. The procedure was presented as a card game in which S had to lay down a playing card for each word segmented. For all stimuli, ten playing cards were made available, though no stimulus contained more than seven words. All stimuli were spoken by E at a normal rate (ie there were no pauses between the words comprising the stimuli) and in a fashion which preserved natural intonational contours. A sentence was repeated if requested.

The metalinguistic term 'word' was never used. During the pretest phase, Ss were shown how to segment utterances into their word constituents. This was demonstrated by E who laid down one card as he pronounced every word segmented. To ensure that Ss understood the nature of the task, several demonstration trials with corrective feedback were provided. Furthermore, to ensure proper processing, Ss were required to repeat the test utterance before playing the segmentation game. Following the practice session, Ss were each presented with 18 test sentences. No feedback was given during the test phase. Immediately after the test, the post-hoc interview was held.

Three procedural features are to be justified here. These concern mainly the selection of the particular elicitation technique employed, the non-use of the metalinguistic term 'word', and finally, the post-hoc interview.

2.1 Elicitation Technique

The selection of the 'card game' as an elicitation technique in this experiment was essentially motivated by pilot studies. In these studies, we used both a word segmentation task where Ss were required to lay down one card representing each word segmented (the one used here) and another version in which cards were aligned before Ss who were required to tap on each one for every word segmented. Analysis of the data obtained from pilot studies, however, indicated that although there was no overall significant difference in the pattern of results (ie there was no task effect), child Ss were found to favour the first version (ie the one used here) and performed slightly, but not significantly, better on it.

2.2 Use of the Metalinguistic Term 'Word'

As previously mentioned, the metalinguistic term 'word' was not used in the present experiment either in explaining the task or in conducting the test. There are three reasons for this. Firstly, use of the term 'word' presupposes that the language in which the experiment is conducted has an unambiguous label for the concept which is hardly the case here as our post-hoc interview revealed.

Secondly, the term 'word' would have been confusing especially to illiterate and very young Ss even if all other Ss knew that what the term meant.

Thirdly, and most importantly, to have employed the label 'word' would have meant confounding awareness of the linguistic unit word with Ss' understanding of a particular item of metalinguistic vocabulary, the name of the unit. Confounding recognition with comprehension of instructions is a common flaw in studies which assume that Ss (mainly children) know what the term 'word' means and include it in the task instructions. For example, Karpova (1977) required Russian children aged between 3 and 7 to respond to the questions: How many words are there ...? What is the first, the second word ...?

One aim in the present experiment was to assess Ss' metalinguistic knowledge of the word as a linguistic unit of spoken language --- in so far as this knowledge or awareness is tapped by a semgentation task ---, rather than to investigate their knowledge of the term 'word'. Furthermore, awareness of the word concept may not be necessarily related to explicit knowedge of the term itself. Indeed, they may develop relatively independently (Tunmer and Bowey, 1983). The distinction is one it is necessary to draw. Failure to acknowledge this has led some researchers to claim that children do not know what a word is (eg Karpova, 1977) or that it develops with age. To say this, however, does in no way mean that assessing such 'knowledge' is uninteresting or unimportant. Quite the contrary, since if we are able to tap Ss' knowlege of the metalinguistic term 'word', then we can help clarify or support certain findings yielded by the segmentation paradigm. Our third procedural feature is concerned with just that.

2.3 Post-Hoc Interview

To extend our findings about Ss' awareness of the word as a unit of speech as tapped by the segmentation task, a post-hoc interview was used which directly addressed their explicit metalinguistic knowledge. The interview (modified from Berthoud-Papandropoulou (1980) and Sinclair and Papandropolou (1974)) included several direct queries with the aim of tapping this explicit knowledge. The interview was basically a single list of questions which ranged from such queries as "What's a word?" to such requests as "Give me a long word".

B. Results and Discussion

1. Subject Variables

1.1 Scoring and Data

The number of items which were correctly identified was calculated for each S and each stimulus subsequently converted to percentages. The relevant data representing the mean percentage of correct responses and standard deviations for each age and literacy group are displayed in Table 4.1.1.

		LITERACY	
		Literate	Illiterate
AGE	Child	53.06 (9.45)	38.29 (9.68)
	Adult	70.53 (9.93)	46.77 (14.50)

EXPERIMENT 1 - Table 4.1.1: Mean percentage of correct responses as a function of Age and Literacy. Standard deviations are in parentheses.

1.2 Analysis and Findings

Analyses of the raw data were carried out following the procedures described in Chapter 2. Two statistical methods were employed, namely, analyses of variance (ANOVA) and Pearson Product Moment Correlations. The ANOVAs were performed on all Ss and materials, whereas correlation tests were performed on the child data only.

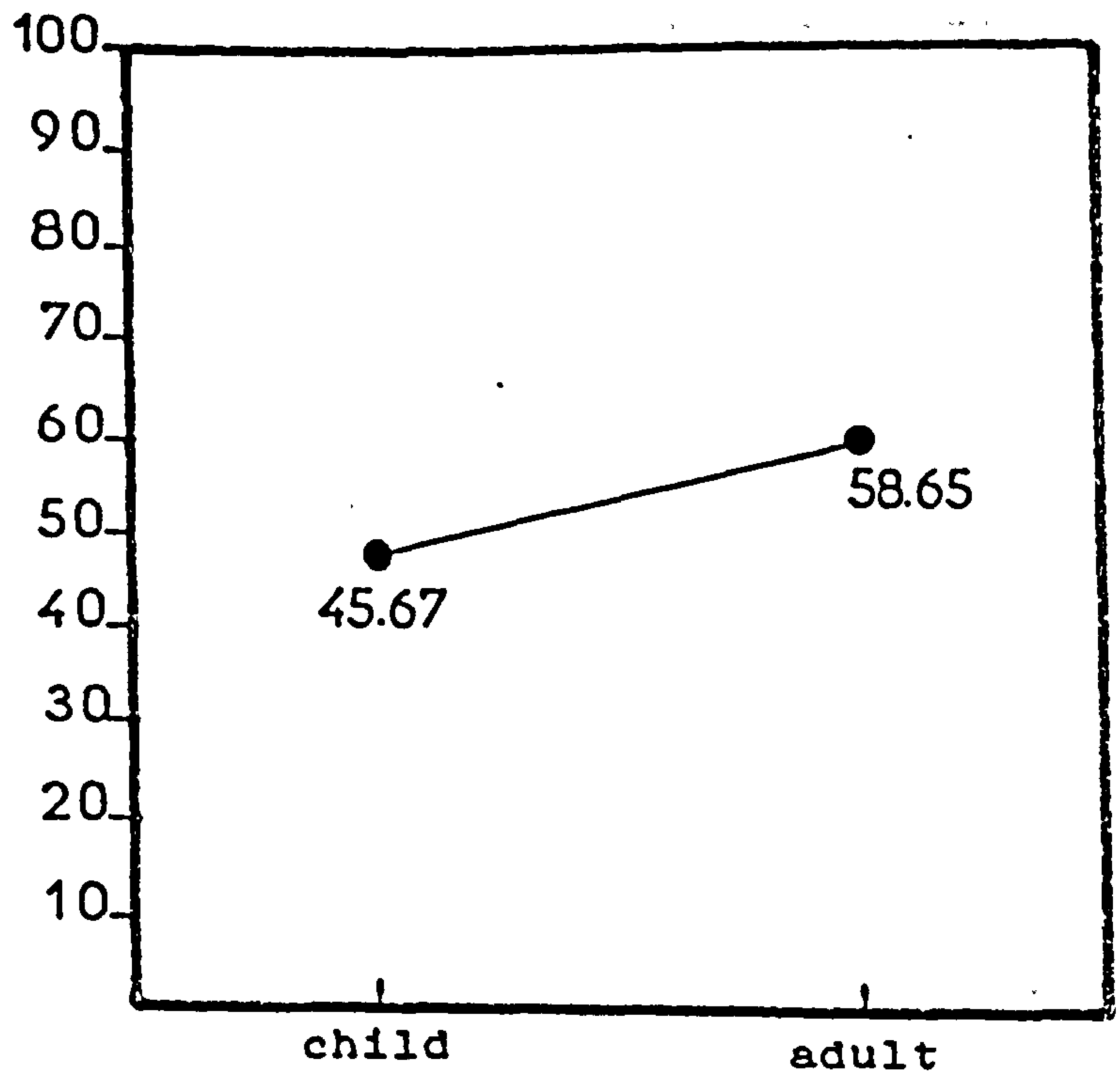
1.2.1 ANOVA

Raw scores for correct items were subjects to two separate (one by Ss and one by stimuli) unequal cell-size three-way ANOVAs with Age, Literacy and Group (each with two levels) as the independent variables. For each effect, F_1 and F_2 will be provided. When they are both significant, min F' will be given as well. F-ratios for main effects and interactions which are of interest to our discussion of the results but not significant, will also be provided.

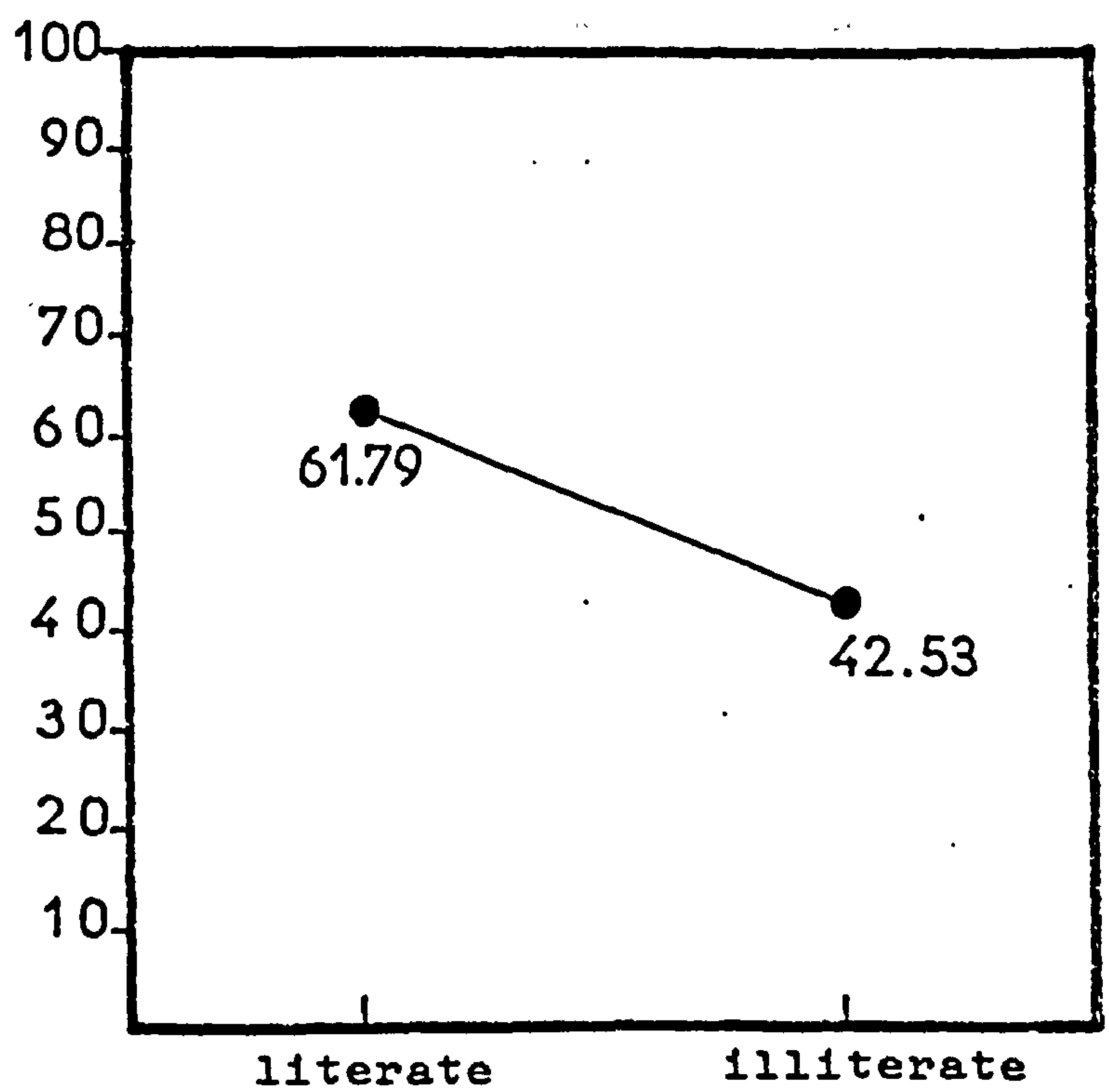
As displayed in Figure 4.1.A, the main effect of Age was significant both by Ss (F_1 (1,112) = 39.28,p < .001) and by materials (F_2 (1,34) = 87.95,p < .0001) with significant min F' (1,142) = 27.12,p < .001), thus reflecting the finding that performance increased as Ss were older. Means for the child and adult Ss were 45.67% and 58.65%, respectively.

The effect of Literacy was even greater than the effect of Age, both by Ss (F_1 (1,112) = 89.44,p < .0001) and by materials (F_2 (1,34) = 166.84,p < .0001, with very highly significant min F' (1,136) = 58.22, p < .001). Means were 61.79% and 42.53% for literate and illiterate Ss, respectively. This result is displayed graphically in Figure 4.1.B.

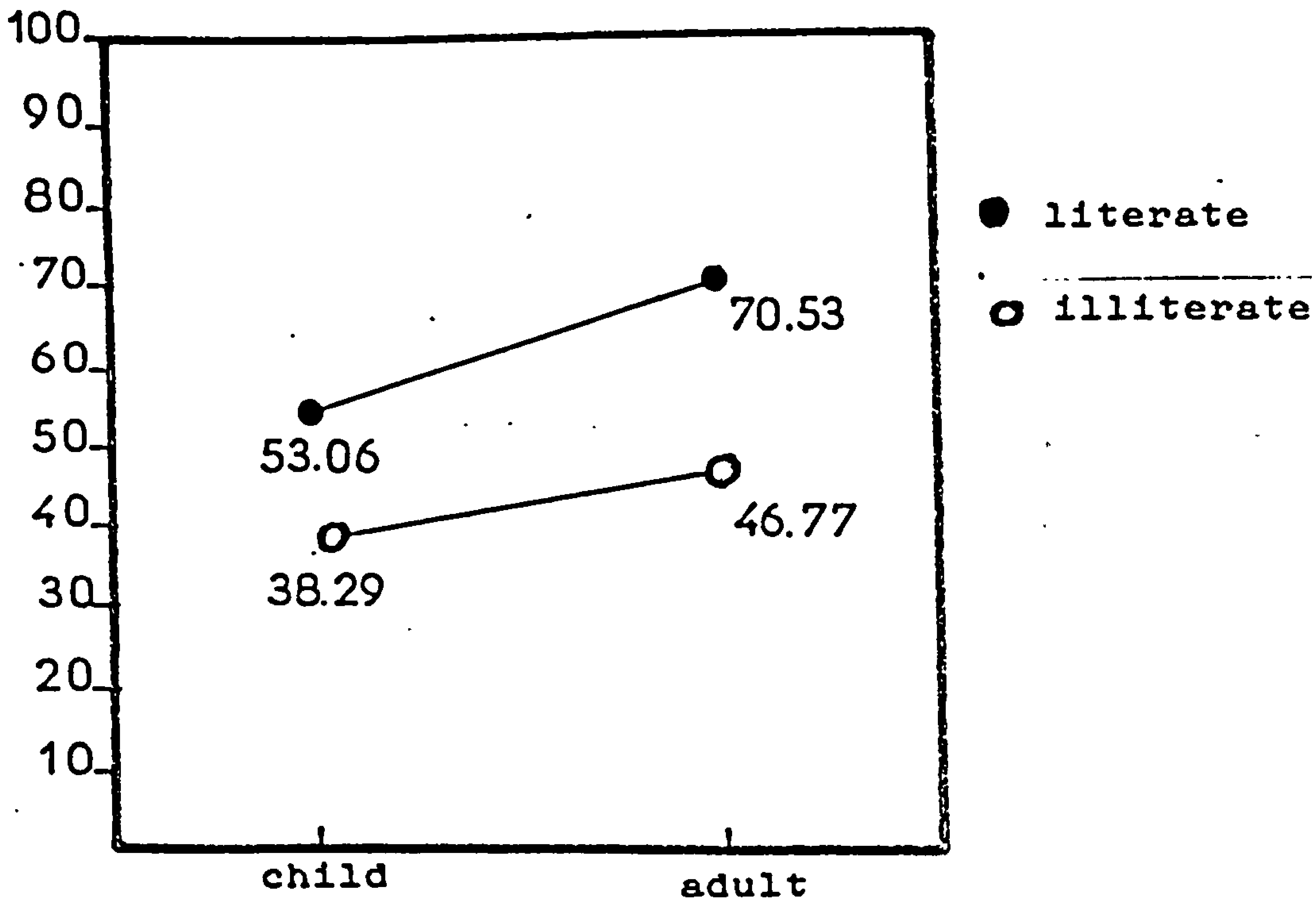
Overall, these data indicate that the ability to isolate words in a meaningful spoken sequence increased with both Age and literacy. However, these values, mask a significant interation between Age and Literacy (F_1 (1,112) = 5.09,p < .026; F_2 (1,34) = 18.85,p < .001; min F' (1,46) = 4,p < .05). Essentially the emergence of this two-way interaction which is plotted in Figure 4.1.C, appears to indicate that the Literacy effect was more pronounced at the older age (70.53% for literates as compared to 46.77% for illiterates) than at the younger age level (53.06% for literates and 38.29% for illiterates). Conversely, the Age effect made more difference among the literate Ss (70.53% vs 53.06% for adults and children, respectively) than among the illiterate



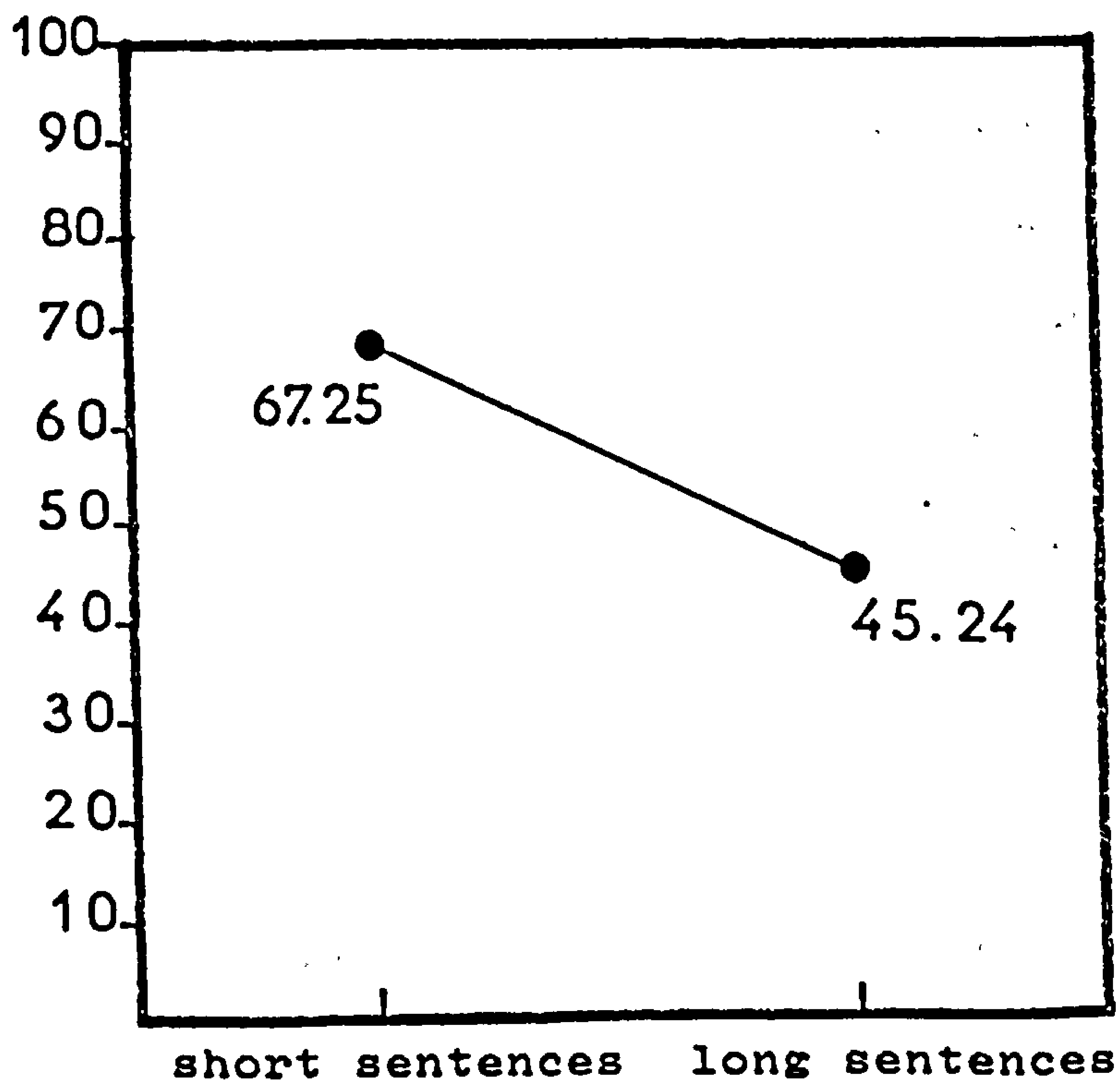
Experiment 1 - Fig. 4.1.A: Mean percentage correct responses as a function of age



Experiment 1 - Fig. 4.1.B: Mean percentage responses as a function of literacy



Experiment 1 - Fig. 4.1.C: Mean percentage correct responses as a function of age and literacy



Experiment 1 - Fig. 4.1.D: Mean percentage correct responses as a function of length of stimuli

Ss (46.77% vs 38.29%). This was significant (Scheffé, $p < .05$). This can be safely attributable to the fact that literate adults surpassed all other groups as well as to the fact that illiterate children performed poorly in comparison with each one of the other groups. An examination of the score distribution revealed that 13 literate adults (or 54.16%) scored above 80%.

1.2.2 Correlations

First order correlation tests were employed to assess the 3-way relationship between the children's chronological age, level of literacy and performance on the task. The aims and procedures were first described in Chapter 2. Briefly, in these correlation tests Age represents chronological age in years and months; Grade represents two levels of literacy (School Grade 1 and School Grade 2) for literate children and one level (No grade, ie absence of literacy) for illiterate children; the Task score represents the percentage of correct responses given by children.

These tests disclosed a substantial relationship between the children's degree of literacy (grade level) and Task score ($r = 0.52$), $t = (1,70) = 8.34, p < .01$ as well as a moderate but significant degree of association between Age and Task score ($r = 0.35$), $t = (1,70) = 4.56, p < .05$. When Grade was held constant, however, the association Age x Task dropped to a negligible level ($r_{\text{Age x Task . Grade}} = .0008$)

indicating that it was dependent on the literacy level rather than age. In contrast, when controlled for age, the significant relationship between Grade and Task ($r_{\text{Grade x Task . Age}}$) was much less affected ($r = 0.40$).

Taken together, these results clearly demonstrate that children's performance is much better predicted by their advances in literacy level than by their advances in maturation, however much these two variables tend to be confounded in the real world.

The tests based on the data from literate children only (school grades 1 and 2) yielded very small nonsignificant coefficent indexes ($r_{\text{Grade x Task}} = 0.043$, ns) and ($r_{\text{Age x Task}} = 0.005$, ns). Means were 53.71% for Grade 2 and 62.6% for Grade 1.

1.3 Summary

To summarize to this point, the results indicate that although word segmentation abilities seem to develop as a function of age (Age is a significant variable wherever it is the only one which applies), their development is greatly facilitated by literacy. Stated another way, age is important, but not sufficient. That some condition is a sufficient on implies that it is, in itself, enough to produce the results. This is clearly not the case here. That literacy is such an important determiner of word segmentation abilities is that illiterate adults were no better at the task than children who had had only about a year of schooling. Further still, literacy appears to magnify the difference between the various groups: Thus, among the literates through the experience over the years, the difference between literate adults and literate children becomes increasingly wider. Overall means were, however, modest. An analysis of the linguistic variables might help to explain why such low scores were obtained.

2. Linguistic Variables

If it is reasonable to ask what factors within Ss affect performance which was the purpose of the sections above, it seems also reasonable to ask what factors within stimuli might influence performance. The purpose of this section is to do just that.

As detailed in the Design section, the design of the present experiment makes it possible to assess the effects of some linguistic variables on Ss' ability to attend to and analyse spoken sequences into their constituent words. Thus, the materials were constructed to vary (i) with Length of the stimuli: sequences were either short or long as measured by the number of words comprising each one; (ii) with the Length of the target words comprising each sequence; targets were either long or short as measured by the number of syllables in each one; (iii) with the Type of word class employed: target words were either contentives or functors.

2.1 Analysis and Findings

2.1.1 Effect of Length of Stimuli

An unequal cell-size 4-factor ANOVA with 2(AGE (child, adults)) x 2(LITERACY (literate, illiterate)) x 2(LENGTH (long, short)) x 2(GROUP (A,B)) was performed over Ss and over materials. In the by-Ss design Ss were nested in Age, Literacy and Group and crossed with Length. In the by-materials design, stimuli were nested in stimulus type and crossed with Age, Literacy and Group. The by-Ss designs used raw data representing the proportion of correct responses obtained by each S in each one of the stimulus types (short vs long sentences); the by-materials design used the mean percentage of correct responses obtained from the scores for all Ss responding to each stimulus type. Means and standard deviations for each age and literacy level are displayed in Table 4.1.2.

LENGTH OF STIMULI

	Short Stimuli	Long Stimuli
CHLIT	71.00 (10.38)	42.82 (11.28)
CHILT	56.12 (13.80)	30.82 (10.42)
ADLIT	87.67 (8.60)	62.05 (13.52)
ADILT	54.25 (13.61)	45.28 (18.20)

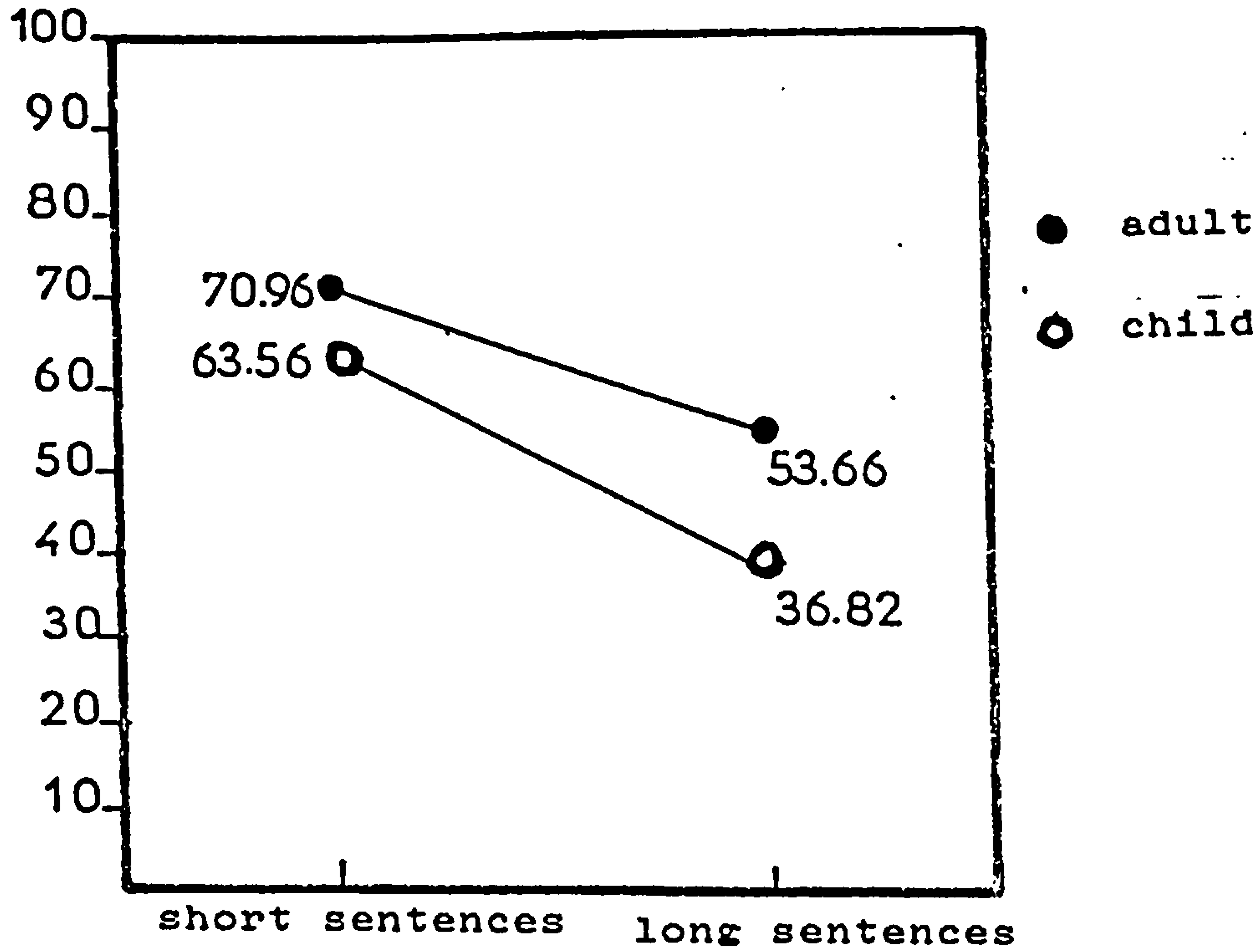
EXPERIMENT 1 - Table 4.1.2: Mean percentage of correct responses as a function of Age, Literacy and Length of stimuli (short stimuli (3-4 words in length) and long stimuli (5-7 works in length)). Standard deviations are in parentheses.

As in the previous analysis, results yielded by this ANOVA also revealed an effect of Age (F_1 (1,112) = 41.40,p < .0001; $_2$ (1,32) = 84.26,p < .0001; min F' (1,35) = 53.36,p < .01) and an effect of Literacy (F_1 (1,112) = 98.72,p < .0001; F_2 (1,32) = 183.99,p < .0001; min F' (1,31) = 63.93,p < .001). The Age x Literacy interaction was found to be only moderately significant in the by-Ss analysis (F_1 (1,112) = 5.97,p < .05), but highly reliable in the by-materials analysis (F_2 (1,32) = 18.23,p < .0002). These two results yielded a significant min F' (1,144) = 4.47,p < .05.

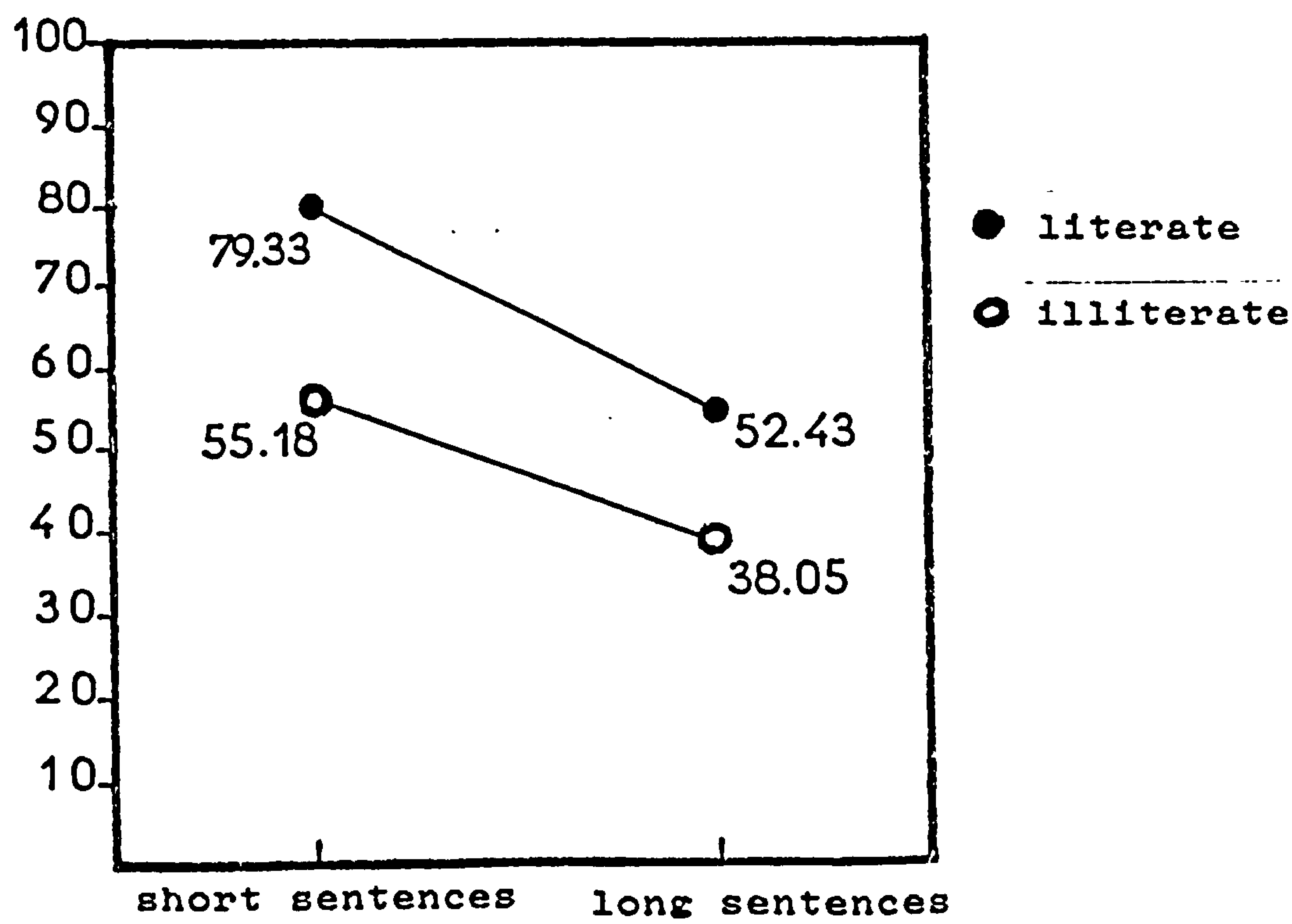
The effect of Length was found to be very highly reliable (F_1 (1,112) = 329.46,p < .0001; F_2 (1,32) = 31.56,p < .0001; min F' (1,38) = 28.66,p < .01) with short sentences ($\bar{X}$ = 67.25%) more successfully segmented than long ones ($\bar{X}$ = 45.24%). Figure 4.1.D. depicts these results.

Of the two relevant interactions, only Literacy x Length reached significance in the F_1 and F_2 analyses, but failed to yield a significant min F'. F-ratios were F_1 (1,112) = 24.43,p < .0001; F_2 (1,32) = 4.52,p < .04; min F' (1,44) = 3.81, ns. Means for the literates and the illiterates respectively were $\bar{X}$ = 79.33% vs 55.18% for short sentences and $\bar{X}$ = 52.45% vs 38.05% for long sentences. This result is displayed in Figure 4.1.F.

This interaction was essentially caused by the fact that while both literacy groups were sensitive to the length factor and while literates outperformed illiterates overall, the length effect was more marked in literate Ss than in illiterate Ss.



Eperiment 1 - Fig. 4.1.E: Mean percentage correct responses as a function of age and length stimuli



Experiment 1 - Fig. 4.1.F: Mean percentage correct responses as a function of literacy

The fall off in literates' performance on long sentences was 26.90% (28.18% for children and 25.62% for adults), while it did not exceed 17.13% for illiterates (25.3% for children and 8.97% for adults). This indicates that there was more variability within the literate sample for long sentences than within the illiterate sample for same variable. Alternatively, there could be a floor effect.

Although it reached significance only in the by-Ss analysis (F_1 (1,112) = 10.93,$p < .0001$; F_2 (1,32) = 1.94, ns), the Age x Length interaction is graphically portrayed in Figure 4.1.E. for purposes of comparison. The figure indicates that length effect was more pronounced in children ($\bar{X}$ = 63.56% and 36.82% for short and long stimuli, respectively) than in adults ($\bar{X}$ = 70.69% and 53.66%).

To summarize, the above results yielded by the three-way (Age x Literacy x Length of stimuli) ANOVA clearly demonstrate that although the overall score varied with Age, Literacy and their interactions, Ss' performance was selectively sensitive to the length of the stimuli as measured by the number of target words comprising each stimulus. Thus, there was a general tendency to isolate words more correctly when they were part of short sentences than when they were part of long sentences. This difference was found to be reliable whether Ss (F_1) or stimuli (F_2) were examined. Furthermore, the existence of only a weak Literacy x Length interaction and the absence of an Age x Length interaction demonstrates that Ss and stimuli were affected although not equally by the Length variable.

These results might be attributable to differences in the difficulty of processing and especially remembering long sentences. This could well have been sufficient to disrupt performance. Put differently, we may have been testing both the ability to segment spoken sequences and the ability to memorize them.

However, there are difficulties with this line of reasoning. First, the arguments appear to be inconsistent with the fact that children as well as adults performed differently on short and long sentences. The absence of any reliable Age x Length interaction demonstrates this. Unless one is willing to assume that adults' memory capacity is similar to children's, this should not occur for reasons of memory alone.

Second, the presence of only a weak Literacy x Length interaction also indicates that irrespective of whether they were literate or not, Ss performed better on short stimuli than they did on long ones. Again, assuming that in general literates perform better than illiterates on memory tasks (eg Wagner, 1977), the former might have performed equally well on both short and long stimuli. We know this was not the case.

Third, these findings cannot be reconciled with the view (eg Chiat, 1983) that it is not at all obvious that short sentences will pose fewer problems than longer ones in processing since length does not necessarily override linguistic complexity. Interestingly, this is all the more true for a language like Arabic in which increased complexity does not necessarily mean increased length. Given the morphology of Arabic, short sentences can be more difficult to process than long ones. What is expressed syntactically in one language may be expressed morphologically in another one, (see for example Dromi and Berman, 1982 who discuss the validity of MLU (Mean Length of Utterance) as a measure of language development for children acquiring Hebrew) [12].

Finally, these results seem to disagree with Tunmer et al's (1983) findings that children's performance on a lexical segmentation task was not affected by length of strings. When we realise, however, that Tunmer et al's experiment employed noun strings only, we begin to realise how the two apparently different findings can be reconciled: Our stimuli contained both contentives as well as functors. We had already hypothesised (see Design) that performance might vary with whether targets were contentives or functors with more success on the former than the latter. And since the number of functors is likely to increase with the number of words in every sentence, (ie the greater the number of words in a sentence, the greater the number of functors), length effect and functor effect may have been confounded.

In light of this, an item analysis was undertaken which revealed the following. First, some long stimuli systematically received scores equal to or even higher than short ones. Second, and more important, long stimuli tended to include more function words than short ones. Performance may have been influenced by the number of functors rather than the number of words. However, the argument that it may be length which caused functors to be missegmented, though unlikely, cannot be ruled out from the data at hand. An interaction between length and functors would be more plausible.

Thus, if as suggested in the foregoing discussion, length factor is not, or more precisely not alone, responsible for a large part of the variance then we should test the possibility that Ss' ability to segment sentences into their constituent words was selectively influenced by the word class membership. If variance is attributable to Length, one would expect similar results for both word classes. Conversely, if word class is responsible for variance, then one would expect different results across word classes. To evaluate this suggestion, a reanalysis of the data was performed.

2.1.2 Reanalysis of Data

2.1.2.1 Scoring and Data

In this reanalysis of the data, a lenient and more liberal scoring system than the original was adopted in which undersegmentation errors involving a functor were not counted as errors. However, no oversegmentation error whether involving a functor or not was allowed. Undersegmentation errors are those in which a functor and a preceding or following contentive were compounded or 'slurred' together as forming one word. By and large functors were segmented as part of their attendant word. An example of this is 'I/put it/on/the/ table/'. Oversegmentation errors, on the other hand, are those in which a word was further segmented into syllables, for example. Segmentations such as 'ta/ble' for 'table' and 'un/der' for 'under' are instances of oversegmentation.

Means and standard deviations yielded by the lenient scoring system are shown in Table 4.1.3. For purposes of comparison, Table 4.1.3 also gives data from the initial analysis (ie strict scoring).

	Strict Scoring	Lenient Scoring
CHLIT	53.06 (9.45)	93.42 (6.54)
CHILT	38.29 (9.68)	87.22 (8.58)
ADLIT	70.53 (9.93)	99.00 (1.56)
ADILT	46.77 (14.50)	91.26 (7.68)

EXPERIMENT 1 - Table 4.1.3: Mean percentage of correct responses as a function of Age, Literacy and Scoring system (Strict vs Lenient). Standard deviations are in parentheses.

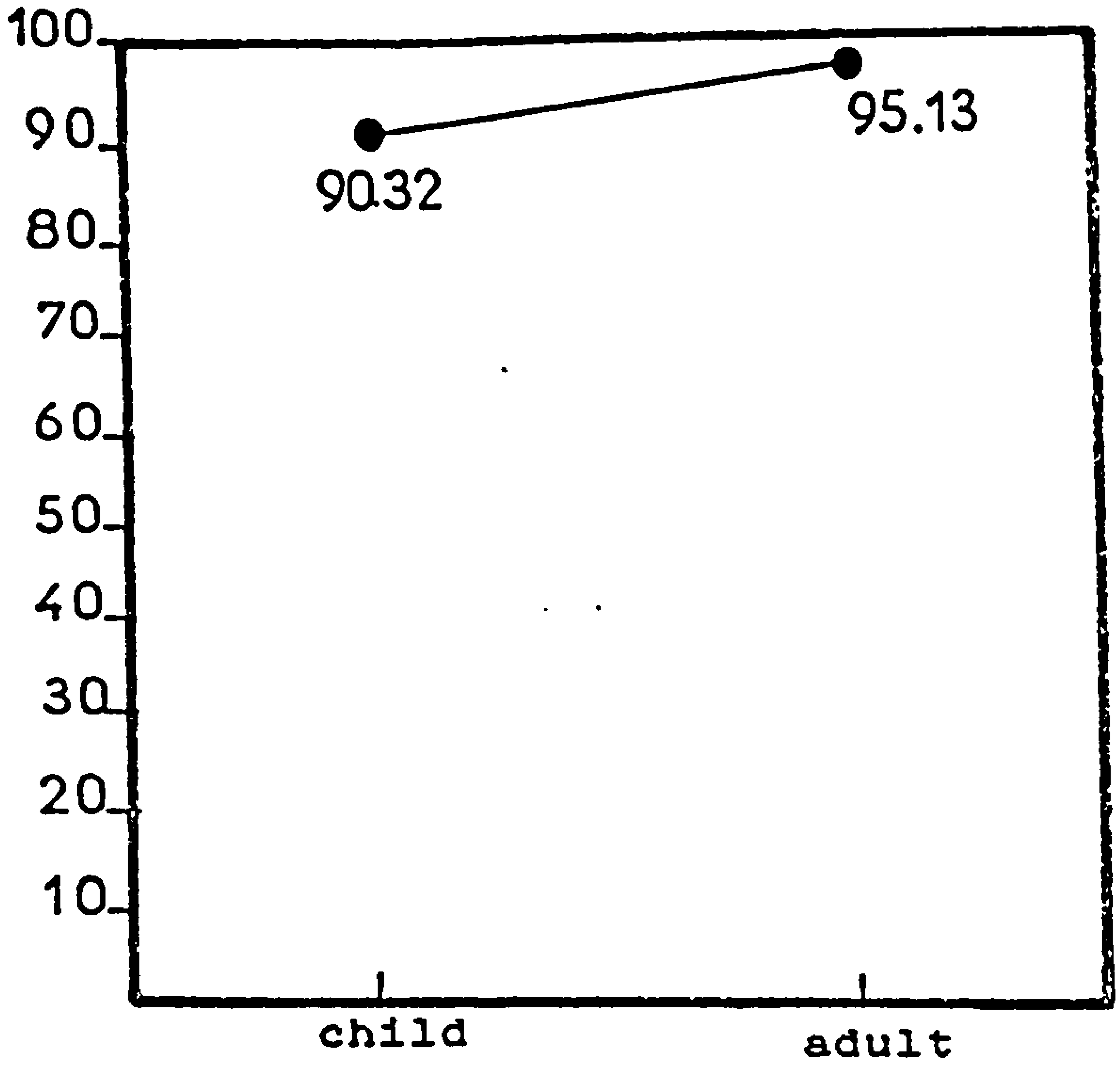
A visual inspection of the data indicates that when we omitted the errors due to incorrect undersegmentation of functors, the percentage of correct responses was considerably higher than that yielded by the original strict scoring.

2.1.2.2 Analysis and Findings

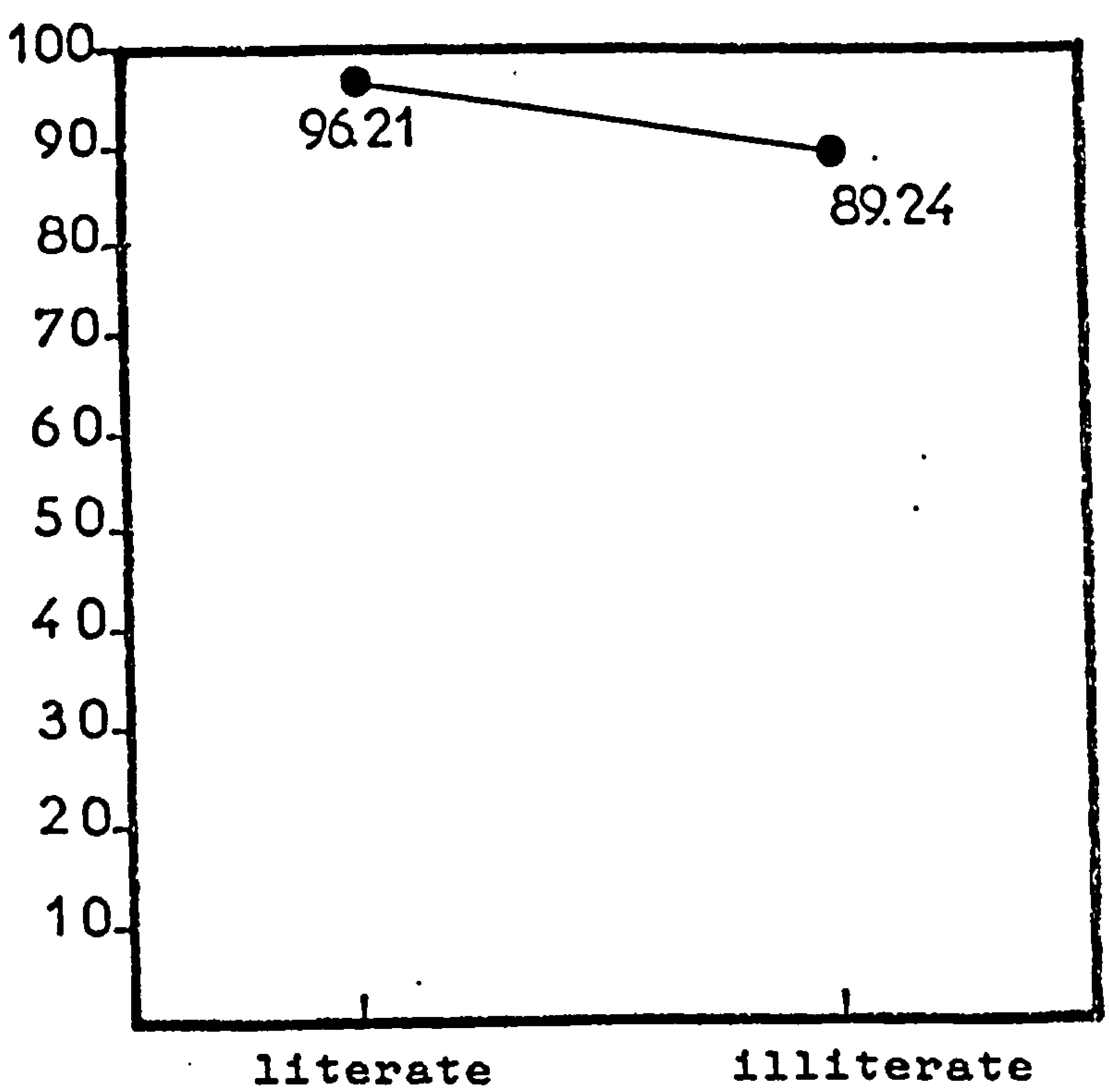
Raw scores yielded by the lenient scoring system were subjected to ANOVAs to determine the effects of Age and Literacy. On this occasion, although the effect of Age (F_1 (1,112) = 12.56,$p < .001$; F_2 (1,34) = 33.92,$p < .001$; min F' (1,145) = 9.16,$p < .01$) and Literacy (F_1 (1,112) = 26.39; F_2 (1,34) = 42.26,$p < .001$; min F' (1,29) = 16.24,$p < .01$) were upheld, they were not as massive as they were in the original analysis. Means for children and adults were $\bar{X}$ = 90.32% (SD = 7.56) and $\bar{X}$ = 95.13% (SD = 4.62), respectively. Means for literates and illiterates were $\bar{X}$ = 96.21% and $\bar{X}$ = 89.24%. Figures 4.1.G and 4.1.H depict these results.

The source of the effects appears to be due to the comparatively lower performance of the illiterate children. The other groups, on the other hand, performed close to a ceiling level. An examination of the frequency distribution of overall scores for all Ss disclosed that 15 literate adults (or 62.5%) performed at ceiling level, while 25 literate children (or 69.4%) scored 90% or better and 15 illiterate adults (or 62.5%) also scored 90% or above. The scores ranged from 95.29% to 100% for literate adults; 82.55% to 100% for literate children and 72.94% to 97.64% for illiterate adults. Of the illiterate children, only 11 (or 30.55%) were able to score 90% or above with overall scores ranging from 64.70% to 97.64%.

The Age x Literacy interaction which emerged in the strict scoring analysis did not even approach and F of 1 in this analysis.



Experiment 1 - Fig. 4.1.G: Mean percentage correct responses as a function of age (Lenient Scoring)



Experiment 1 - Fig. 4.1.H: Mean percentage correct responses as a function of literacy (Lenient Scoring)

2.1.2.3 Effect of Length

Means and standard deviations obtained for each length level are presented in Table 4.1.4

	LENGTH	
	Short Stimuli	Long Stimuli
CHLIT	96.62 (6.00)	91.60 (8.31)
CHILT	90.82 (9.83)	84.94 (10.72)
ADLIT	99.45 (1.26)	98.74 (2.02)
ADILT	89.79 (10.58)	90.22 (8.31)

EXPERIMENT 1 - Table 4.1.4: Mean percentage of correct responses as a function of Age, Literacy and Length of stimuli: Lenient scoring. Standard deviations are in parentheses.

An ANOVA by-Ss and by materials revealed that the main effect of length was not generalisable both to Ss and to stimuli. It recurred only by Ss and with a much smaller F-ratio than in the strict scoring (F_1 (1,112) = 10.26,p < .001. Means were 94.17% for short stimuli and 91.37% for long stimuli. (Compare with 66.38% and 45.24% in the strict scoring.)

Of the two relevant interactions Age x Length was significant only by Ss (F_1 (1,112) = 10.89,p < .001; F_2 (1,32) = 0.03,p > .08) and Literacy x Length reached significance only by stimuli (F_1 (1,112) = 0.04,p > .08; F_2 (1,32) = 6.27,p < 0.001).

Taken together, these results, then, indicate that performance observed in the strict scoring analysis could not have been entirely due to stimulus length operating on the ability to segment words from spoken sequences. Rather, and as the lenient scoring analysis clearly demonstrates, the increase in errors with the length of the stimulus sentences appeared to be largely attributable to errors (mainly undersegmentation errors) with functor words in long sentences: Ss operated on the basis of a strategy that was especially sensitive to word class and not to sentence length. Furthermore, the lenient scoring system has revealed that literacy did not facilitate performance on contentives. Functors, rather than contentives appear to be more sensitive to literacy. This may help to explain the score differences observed in the original analysis between the literates and the illiterates in general, as well as the literate adults and the other groups in particular.

Now, if our interpretation of the various results is correct, then, there may be no need for any general quantitative analysis to be performed, for the major points these findings make is obvious. Instead, we shall, in the next section, attempt a qualitative analysis of the data. More generally, we are interested in the strategies adopted by Ss in responding to the task. By doing this, we shall be able to gain some insight into the underlying processes involved in Ss' decisions when consciously segmenting sequences into their word constituents. One way to do this is to perform an error analysis.

2.1.3 Qualitative Analysis

As stated above, the qualitative analysis was undertaken to shed some light on the difficulties that are experienced in performance of the task, the strategies adopted when facing the task, and finally the association between error categories and the subject variables of age and literacy.

Responses based on the lenient scoring system were inspected to determine if patterns could be discerned. Four main categories were then constructed which appeared to accommodate all responses. These categories were:

(i) undersegmentation
(ii) oversegmentation
(iii) conversational responses
(iv) omission and substitution

In the next section we describe and discuss each category in turn. Specifically, we report on the error distribution as a function of age, literacy and type of error. Following that, we compare all categories and discuss segmentation strategies adopted by Ss.

2.1.3.1 Undersegmentation

Since our data are based on the lenient scoring system adopted in the second analysis of the data, errors due to undersegmentation but involving functors were not included. Rather, errors in this category include compounding two or more words, none of which was a functor, and treating them as one single unit. For ease of reference and to distinguish it from undersegmentation involving a functor, this strategy will be referred to as 'clumping'. This strategy constituted a sizeable proportion of the total number of errors committed by all Ss (43.70%). This strategy was exhibited more often by children than by adults and more often by illiterates than by literates.

An item analysis disclosed that compounding verbs with their objects (V + O) accounted for more than half of the errors, while verbs with adjectives (V + Adj) and nouns with adverbs (N + adv) represented 25% and 20%, respectively. This is an indication that Ss were able to break sentences at least into subject and predicate. Commonly occurring phrases were sometimes accorded the status of word.

2.1.3.2 Oversegmentation

Errors in this category included segmenting whole or part of spoken sequences into entities smaller than the word. A substantial portion of these entities were syllables or syllable-size bound morphs. We must admit that it was not an easy task to decide whether an entity was segmented out because it was a bound morph or because it corresponded to a syllable. Syllabicity (or lack of it) may be one factor affecting segmentation of affixes. In a segmentation task such as the present one, syllabic segmentation can be unambiguously observed only in free morphs containing no affixation. However, since segmentation of words into either 'true' syllables and syllable-size affixes involves the same strategy, ie oversegmentation, and since the number of syllable length affixes was significantly lower than the number of sub-morphemic syllables (sentences contain more syllables than affixes), it was decided to include them both in the same category.

As hypothesised (see Design), polysyllabic words were more often easily divided into syllables than bisyllabic words. On the whole, both child groups were observed to use the syllabic strategy more often than adults.

2.1.3.3 Conversational Responses

Unlike the first two categories, errors included in this one were not directly caused by any error of judgment during segmentation decision making. Rather, they were errors elicited by the very content or form of the stimulus. Specifically, these errors were much more likely to occur when the task stimuli were interrogative sentences. These were treated as if they were conversational questions requiring a direct reply, hence the label "conversational responses". Thus, instead of segmenting interrogative sequences as presented to them, there was a tendency in Ss to segment their answers to these sequences. For example, the stimulus "What did you buy from the shop?" elicited the segmentation of "I bought bread and butter", and to the stimulus "When did you return from school?" one response was "when did I return from school?.. I don't go to school".

It is interesting to point out that virtually all errors in this category were committed by illiterate Ss with children erring more often than any other group. As noted previously, errors in this category were not due to Ss' failure to segment stimuli into their word components, nor were they caused by any difficulty to comply with the instructions since it is clear that responses were stimulus specific: only interrogative sequences were responded to in a conversational manner. Furthermore, these responses were subject specific since they varied with literacy: they were virtually all given by the illiterate sample.

These errors yield some evidence that some Ss reacted spontaneously to the meaning aspect, not the form aspect. Although the data are based only on four items which were interrogative, this is an interesting empirical finding for our general research, since ability to ignore the conversational context prompted here by the interrogative sentences is just what is required in a metalinguistic task in which attention is to be focused upon language per se distinct from the situation it describes or the context in which it arose. While we shall have occasion to return to this point in subsequent chapters, we note here (if we are allowed to speculate at this point) that the fact that the trend was found among illiterates and not literates is in agreement with Olson (eg 1982) who has proposed that written language may be the basic source for the distinction between what is said and what is meant. In his own words, "writing preserves the surface structure, what was said, independently of the intention it expresses, what was meant." (p 12).

2.1.3.4 Omission and Substitution

This fourth and last category comprises cases in which misremembered words were either omitted entirely or replaced by others during the segmentation process [13]. It also includes errors caused by perseverance. That is, words and sometimes whole phrases were replaced by words and phrases from the preceding stimulus due to a neighbourhood effect. Perseverance of an entire sentence was also observed.

However, errors in this category are of very low frequency which indicates that requiring Ss to remember and repeat sentences while they segment them does not affect their performance. It further confirms our previous finding that the length factor did not affect Ss' performance by causing them to omit or substitute words. It must be pointed out, however, that when they occurred, they were more often than not committed by illiterate Ss.

To summarize this section, when findings from the various analyses of errors are considered in combination, three observations seem to emerge that characterize Ss' performance. First, when Ss failed to operate accurately, they more often than not exhibited a non-random strategy. Second, the data suggest that the illiterates perform in a qualitatively different way from the literates. Third, Ss were, more often, sensitive to the linguistic factors within the stimuli.

3. Implications and Conclusion

In what follows, we consider some implications of these findings for metalinguistic awareness and for some other related research areas. More specifically, our discussion will focus on (i) why Ss were sensitive to word class. In particular, why functors were found to be less available than contentives and (ii) does Ss' concept of word correspond to that described by conventional linguists?

In light of our findings, there may be more than one way of approaching the question why Ss have problems with functors. One would be to argue that Ss rely on certain prosodic cues rather than on an abstract concept of the word as a linguistic unit. One's first candidate must be stress, and since functors tend to be phonologically inconspicuous, this may explain why Ss failed to isolate them. Some evidence for this conclusion might be drawn from some studies of language acquisition. Thus, Wanner and Gleitman (1982) conjecture that children acquire language on the basis of the words stressed syllable. The authors argue that the existence of "telegraphic speech" which is characterized by the absence of function words is an illustration of this. More evidence comes from research by McWhinney (1976), cited in

Wanner and Gleitman (1982) which shows that in Hungarian, where main stress always occurs on the first syllable of a word, children acquiring the language rarely make segmentation errors that cross word boundaries.

However, the prosodic (in this case stress) explanation suggested above may not, after all, be a plausible one. There is at least one objection that Wanner and Gleitman themselves consider but dismiss: If the language acquirer is differentially sensitive to stress in the speech signal, he should not be able to tell - for a stress language like English - the difference between an unstressed morpheme and the unstressed syllables of monomorphemic words [14].

Another objection to the 'stress explanation' comes from Chiat (1979) who points out that though words may be defined theoretically by their ability to carry contrastive stress, it is nonetheless "clear that a significant number of words realise this ability only on rare occasions" (p 600). According to Chiat, a sentence such as "I saw <u>àn</u> alligator, but not <u>thè</u> alligator that everyone's talking about" is a somewhat unusual one. It is very unlikely that articles would be isolated by children on the basis of such a sentence; it is much more likely that children acquire articles, and perhaps even deduce that articles may undergo stress, without actually witnessing utterances in which articles do undergo stress. Furthermore, it is not the case that stress fails as a cue to word identification with unstressed words only. It is also of no help in determining word boundaries. Chiat contends that "The child may register any syllable in the speech chain which bears contrastive stress as another word, but still not know where that word begins and ends, since the stressed syllable may be a word in its own right, or it may merely be the stressed syllable of a polysyllabic word." (p 600).

Finally, at least one study in metalinguistic awareness in children had suspected that stress may be important in word segmentation. Holden and McGinitie (1972) had suggested that the rhythmic pattern of utterances may influence segmentation, and since functors are not normally stressed, this may explain why Ss failed to isolate them. In one experiment, Ehri (1976) had children utter a sentence in a monotone with stress on each word (including functors). However, despite this procedural modification, she found that children's performance on contentives were better than functors. One objection to Ehri's study, however, is that normal pronunciation of normally unstressed words may have made them even more difficult to recognise as words. It rests with future research to shed more light on this. It would be revealing, we suggest, to investigate data on acquisition and use of Sign Language in deaf Ss for insights into how unstressed words and functors in particular are treated. There is an indication (Borstein et al, 1980), for example, that American children who use Sign Language do not consistently produce signed inflections. More interestingly, a recent preliminary study by Zorfass (1981) explored abilities of deaf children aged 4 to 7 who are users of signed English explicitly to segment signed English sentences into words. This study revealed that the percentage of omitted signed function words was significantly higher than words with 'lexical meaning' (ie contentives). More research is needed to clarify and substantiate this.

A second explanation would be to consider functors as carriers of less information than contentives [15]. This may preclude Ss attending to them. However, some evidence from language acquisition (Slobin, 1966; Wanner and Gleitman, 1982) appears to indicate that this may not be so. For example, children learning Russian appear to omit inflectional affixes that are the main device for making the thematic (semantic- relational) roles in that language, and adopt instead a word-order streategy that has poor support in the input data. In light of this, it is impossible to suppose that functors are not salient on the grounds that they lack semantic markers. Again, as with the previous explanation (ie the stress explanation), more research is needed here as well.

A third and final explanation is a syntactic explanation. That is, it may be that functors lose their functional identity as the sentence is fragmented. Alternatively, their lack of salience may be due to the fact that they serve to assign syntactic structure (ie their roles are relational during sentence processing rather than semantic-referential). Thus, in a segmentation task such as the one at hand, when a sentence is fragmented, function words may lose their functional identity [16].

Some evidence that may support the syntactic explanation comes from a study by Januschek et al (1979) who required five- and six-year-old children to tell the first word of either a three-word sequence or a whole sentence to a toy figure. The study revealed that isolating the first word from a coherent text was for both age groups significantly more difficult than from a sytactically and semantically unrelated material (eg book cakes garden). Likewise, in an experiment exploring the effects of form class and context on word learning, Glanzer (1962) presented adults with real words flanked by nonsense syllables (eg "Yig food seb" and "tah of zum"). Each sequence was learned as a response to an alphabet letter. The author found that preposition and conjunction sequences were recalled better than the other form class sequences, presumably because the syntactic function of these words was activated by their contexts and so eased the response learning task [17].

In sum, while we seem to be cautious at favouring one explanation over another, we are confident that, at least from a methodological point of view, the present experiment demonstrated that if we had not considered the contentive/functor distinction, we would have drawn inaccurate conclusions. Whatever the reason for S̲s finding functors less available than contentives, the fact remains that these two word categories dissociate clearly from each other.

A recent study by Bradley and Garrett (1981) cited in Bruskin and Blank (1984) revealed that functors and contentives are treated differently even in visual perception. Thus, when both word types were presented to the left visual field (right hemisphere), normal S̲s had relatively poor but equal accuracy in the identification of both classes of words. When the words were presented to the right visual field (left hemisphere), S̲s' performance increased in accuracy. Of greater interest, however, is that the two classes were treated differently, with functors being more poorly identified than contentives. Bradley and Garrett propose that access to non-content words in the left hemisphere of normal Ss is through a different mechanism from that which handles content words, whereas in the right hemisphere the same retrieval mechanism serves to access both word types. The authors conclude that even if differential access exists, it is not known yet whether it is innate and/or dependent upon experiential factors, ie those factors we have been considering in the present experiment (eg stress pattern of content and noncontent words, semantic and syntactic roles).

While it is premature to state for the moment which factors alone or in combination cause or contribute to the 'functor effect', one thing is certain: Our illiterate Ss' concept of word does not always appear to correspond to the minimal free unit of language as described by conventional linguists. Thus, for our Ss, this unit may consist of more than one word. In other words, while words, and morphemes may be the ultimate units of grammar in a description of a language by the linguists whose overriding concern is with economy of description, the actual units used in speech processing may be different. From our study, it appears that these units may consist of more than one word: a phonological (?) word rather than a grammatical word. Thus, there are strong links between nouns and their associated prepositions. This is not surprising. The integrity of noun phrases has already been shown to have a psychological reality. Early in 1926, Piaget reported that the illiterate people of Gola in Liberia were ignorant of the fact that their language consisted of "words". The real unit for them was the phrase. The view that the sentence even is to be the true prime unit of human speech and that words are figments of the linguist's imagination is held by Old Indian grammarians (eg Bhartrhari who saw the sentence as indivisible - see Bugarski, 1976). This view, is observed in the writing system where words were often run together in the use of Devanagari script. Bugarski suggests, however, that such a view may not be altogether unrelated to graphic conventions.

In any case, the forms of the 'word' that Ss intuitively feel belong in a group do not differ much from the conventions utilised in print. Thus as Chomsky and Halle (1968, p 368-71) also point out, in Arabic and Semitic writing systems in general, articles and prepositions show that determiners and definite articles are grammatical devices that are inextricably linked with nouns. It is important to note that the segmentation of words in a written text is a rather late historical achievement in alphabetic scripts. Apparently, early Greek texts were written without segmenting words (Coulmas, 1981).

The difficulty that Ss have in segmenting speech into 'words' is also reflected in the spontaneous writings of modern preschool children who do not show word boundaries or connect function words to one unit (Bissex, 1980). But it rests with future research to explicate the relationship between word concepts and rules of graphic representation.

In sum, the obviousness of the 'word' may perhaps be more apparent than real, perhaps the results of years of seeing words in print separated by spaces. However, the fact that nonliterates are aware of words, may make words psychologically real units of language. The problem is one of linguistic definition: A full definition of 'word' is yet to be articulated. On this, it is obvious then, as Bowey and Tunmer (1983) suggest that one "must differentiate degrees of word awareness" (p 33). To the extent that our <u>S</u>s have differentiated a larger proportion of words from other linguistic units (eg syllables, morphemes, phrases, (?) sentences), we are in a position to say that <u>S</u>s are aware of "word" whatever that is [18].

FOOTNOTES

1. For example, early observations by Sapir (1921, p 33-35) suggested that while illiterate Indians found morphemes very hard to isolate, they had no problem in identifying words in an utterance. Apparently, it is this preliterate awareness of words as units of language which has been employed in the development of writing systems which use words as the units of print (see Gelb, 1963, for example).

2. However, a reasonably detailed procedure for isolating phonological words is proposed in Chomsky and Halle (1968) and later in Selkirk (1972). From a syntactic point of view, Postal (1969) proposes that the word as a syntactic unit corresponds to the "anaphoric island" which is a syntactic string the internal elements of which cannot participate in anaphora. A definition of word, as a semantic unit is yet to be achieved. Following Aronoff (1976), the term 'word' as used throughout this study refers to 'inflected word' rather than lexeme which is 'uninflected word'.

3. Where such a definition is proposed, it is a literate one. The oft-quoted definition suggested by Bloomfield who defines a word as a minimum free form, ie the smallest form that can occur by itself is unsatisfactory. For one, it is a literate definition: words do not normally occur by themselves. Second, it works best for written English where conventionally space is left on either side of a word. Other writing systems such as Devanagari do not leave spaces between words.

4. In Arabic writing, in addition to space between 'words' the shape of some letters may also indicate whether they are word-final or word-initial.

5. Admittedly, this term is somewhat vague, hence the use of quotation marks.

6. In one experiment, Osgood and Hoosain employed morphemes such as -ment and found that they were reported less often in a tachistoscope than words of the same length, like mend, even though the form-ment occurs more often in the language than mend.

7. According to Osgood, nominal compounds like 'stumbling block' represent an emergent composition of semantic features (a kind of idiom) and they function like single words linguistically, accepting insertions freely at their boundaries but not within.

8. It is important, however, to note that in Arabic morphology, in contrast to English, increased complexity does not necessarily mean increased length. In other words, it is difficult to establish direct comparison between a synthetic language such as Arabic and English which has a morphemic complexity which correlates with the length or words.

9. According to Johns (1979), this finding may be explained by the fact that these children were receiving formal reading instruction for the first time. Perhaps they view words as the 'short things' that appear in their basal readers.

10. We note here that no theoretical relevance is attached to this particular classification and it will be obvious that certain items would be subdivided further and that others are 'misplaced'. For example, some lexemes (uninflected words) which we have considered prepositions here are identified according to the criteria established by Arabic grammar as substantive-derived locative adverbs (or duruf).

    In Arabic as in other semitic languages, most nouns and adjectives are constructed out of a combination of a (usually tri-) consonantal root plus associated affixal patterns. Further, nouns and adjectives are inflected for plural number, and while all nouns are either masculine or feminine in gender, adjectives agree with their head nouns in both gender and number. Verbs, on the other hand are constructed out of a consonantal root and are marked for number, gender, person, tense and mood.

11. In Arabic, prepositions always precede the reference point, but differ in form. They may be classified into three groups according to form (phonological and syntactic) and semantic information:

    (1) Free form prepositions: These forms are free in the sense that they are represented by a single unit in both phonology and orthography. These forms include all prepositions which are represented in the orthography as separate words and which are not affected by the initial element or elements which they precede. Examples include ʕla/ʕəl 'on'; mən 'from'.

    (2) Enclitic prefixes or prefixal prepositions: These forms are attached enclitically to the following reference point (usually a noun or a pronoun) with which they form a phonological unit. These enclitic prepositions incorporate the definite article. Typically, the realisation in print of these forms is that they are joined together.

    (3) Fused forms: These occur whenever a free or enclitic prepostion is followed by a pronoun rather than by a full noun.

12. As Lyons (1968) observes, syntagmatic relations do not necessarily presuppose an ordering of units in linear sequences, such that the substantial realisation of one element must precede the substantial realisation of another in time (p 76).

13. Substitution attributable to dialects, as for instance when Ss change stimulus 'wəld' to 'derri' (both mean 'boy') were not counted as errors.

14. Wanner and Gleitman, however, claim that there is a good evidence that children cannot make this distinction very well. For example, it is striking that words are often pronounced as their stressed syllables (eg "raff" for "giraffe"). According to the authors, it is particularly interesting to note the frequent misanalysis of clitic pronouns as the unstressed syllables of preceding syllables, for example "read-it" and have-it", yielding such utterances as "Read-it book? and "Have-it cookie?

15. We note here that functors are also known as "empty words".

16. It has been suggested (Lawler, 1976) that the compounding of function words with the following content words in a segmentation task might indicate that functors are sensed as a type of contentive-preceding inflection for function, much as case endings in Latin and terminal inflections for function, ie functors are treated like inflections.

17. Functors are also called 'context-dependent words' (eg Luria, 1981 p 133-137).

18. Bever (1977) suggest that "the word serves as the reflection of a point of intersection between acoustic, semantic and syntactic structure" (p 84). That is, words serve as the units with abstract properties that are intermediate between sentence production and perception.

CHAPTER FOUR

I Introduction

Two aims underlie this chapter. The first aim is to assess the ways in which metalinguistic knowledge is deployed in the process of attending to, identifying and manipulating the syllable as a unit of speech.

In pursuing this aim, a second aim emerged. We wanted to alter the methodology of previous research to design tasks appropriate for both children and adults and, at the same time, well-suited for investigating different speech units. This Chapter makes a contribution to the methodology of metalinguistic research by presenting a new elicitation technique which is described under Experiment 2.

The three experiments reported on here were designed to:

(1) assess Ss' ability first to focus on, identify and extract syllables in word-initial (Experiment 2) and word-final position (Experiment 3), and second to manipulate syllables by rearranging their order in a sequence (Experiment 4).

(2) determine the linguistic factors which might have an effect on Ss' performance on the various tasks. The relevant linguistic factors are described under each experiment, as appropriate.

Before describing the experiments, however, we should first consider what is known about syllables that might be relevant to our understanding of the problems that may face Ss in performing the various metalinguistic tasks. Accordingly, the next section examines the status of the syllable in a general theory of language structure and in linguistic behaviour.

II The Status of the Syllable

A. In Phonological Theory

Although the syllable has been recognised as an important unit in speech perception and production, it has remained notoriously elusive and resistant to any unambiguous definition.

In phonological theory, the syllable is more often appealed to than defined. Its place as a unit has long been controversial. While some linguists have posited it as a 'natural perceptual unit' (eg Hooper, 1976), others have denied its reality as a relevant category or simply ignored it entirely. For example, in the standard generative phonology (represented by The Sound Pattern of English (SPE), the syllable has been largely ignored on the assumption that all phonological generalisations could be adequately captured in terms of individual segments or sequences of segments.

After having been given short shrift in SPE, the syllable has however, received more attention in subsequent phonological research.

Recently, there has been a substantial increase in the attention to syllabic processes in phonology as a result of the inability of standard linear phonology to handle certain linguistic phenomena (eg stress, harmony and tonal phoneme) in an insightful way, but more likely, perhaps, as a response to new data from phonetics, child language acquisition and experimental work in speech processing. Whatever the causes, syllabic phonology is now solidly centre-stage. A variety of proposals have been made for enriching the linear segment-based model of classical generative phonology by recognizing a phonological structure superordinate to the segment. Work such as that of Hooper (1972, 1973), Halle and Vergnaud (1976), Kahn (1976), Bell and Hooper (1978), Anderson and Jones (1974) has brought the notion of syllabic structure into central position in current theorizing. It has become apparent that many phonological rules only receive appropriate formulation in terms of this notion. In English phonology, for example, Kahn (1976) has shown that there are at least eight rules which have syllable structure conditioning. Hoard (1971) has found that apparently unrelated phenomena of aspiration and tenseness of consonants find consistent explanation with a few syllable rules. Likewise, in Arabic phonology, a syllable-based description has also been shown to account for many linguistic phenomena. For example, Broselow (1979, 1980, 1981) has demonstrated that the syllable provides conditioning environment for certain phonological rules in Cairene Arabic (eg epenthesis) and accounts for the relationship between word juncture and pronunciation. She further contends that the "generalisation that the syllable is the domain of emphasis in Cairene Arabic would be obscured in a grammar which did not make reference to syllable structure" (p 349). Such an approach to emphasis (or pharyngealization) as a property of the syllable was also adopted by Sha'aban (1977) for Omani Arabic and by Benhallam (1980) and Sayed (1981) for Moroccan Arabic [1]. Saib (1978) adopts the same approach in his account of emphasis in a dialect of Berber.

Concerning the structure of the syllable there has ensued extensive discussion in the works of such authors as Kiparsky (1979), McCarthy (1979), Halle and Vergnaud (1980), Cairns and Ferstein (1982) and others, who have argued that the syllable has an internal constituent structure, the segment being its terminal string; their work thus rejoins earlier theories of the syllable such as those of Kurylowicz (1948), Pike (1948) and Fudge (1969). Within these theories, definitions of a possible syllable for a language and the possible segmental associations to it express basic phonotactic generalisations about the language.

B. In Psycholinguistic Theory

Further supportive evidence for the fundamental importance of the syllable comes from behavioural sources. Speech perception is one such source. The literature on lexical access in fluent speech processing suggests a syllable-based route. Before we review some major findings, a brief description of the techniques employed in this type of research is in order.

The more common paradigms which were used to assess this were shadowing and target detection or monitoring tasks. In a shadowing task, Ss are asked to repeat verbatim (or shadow) a passage as they hear it and as rapidly as possible. They are instructed to include any mispronunciations that might occur in that passage. The measure of interest is Ss' reaction to mispronounced words: whether they supply the word in its connected form, repeat the word as mispronounced, hesitate and so forth. In a target detection task, Ss are instructed to listen for the occurrence of a specific sound, either an individual phoneme, a syllable or a word, or Ss may be asked to listen for and detect a mispronunciation of an unspecified type. They either indicate mispronounced words on a script or push a button upon hearing a mispronunciation. In the first case, the dependent variable is simply the proportion of detections. In the second case, the proportion of detections as well as reaction time (RT) can be measured.

Savin and Bever (1970) used a target-detection task to determine the perceptual reality of phonemes and syllables. Ss were required to detect as rapidly as possible either an initial consonant phoneme or an entire syllable target in a list of nonsense CVC syllables. Thus, Ss had to respond either to the phoneme /b/ or to the syllable /bap/ in the target. They found that Ss systematically took longer to respond to the individual phoneme. From this finding, Savin and Bever concluded that Ss apparently processed the stimuli as entire syllables first, and then broke these syllables down in order to extract the respective component phoneme. That is, phonemes were not perceived directly but were derived from an analysis of the syllabic perceptual unit. This was also replicated by Warren (1971) using sentences rather than individual CVC nonsense syllables as stimuli. An alternative explanation of the finding was offered by Foss and Swinney (1973) who made a distinction between perception and identification of a linguistic unit, with perception being an automatic pre-conscious process, and identification being overt, conscious act. They suggested that smaller units are identified by breaking down larger ones providing a rather different argument for the same conclusion.

In a series of studies, Mehler et al (1981) and Segui et al (1981) examined in more detail the role of the syllable in both adult and infant speech perception. They showed, for example, that Ss responded differently to pairs of words sharing the first three phonemes but having different syllable structure. Faster reaction times were observed when the sequence corresponded to a syllable of a target word that when it did not. Thus native speakers of French identified the target /pa/ faster when it occurred in 'palace' /pa./ than when it occurred in 'palmier' /pal./. In another experiment, by the same researchers, two target types V and VC (eg /a/ and /al/ in the two target words "palace" and "palmier") were presented to Ss for detection. This experiment was based on the assumption that if Ss segment the signal syllabically, then they would respond faster to /al/ when it is contained in the same syllable (ie palmier) than when it is found in two different syllables (pa.lace). Ss detected the VC target type faster when it belonged to the first two syllables (ie it was faster in 'palmier' than in 'palace'). The results suggest that the speech segment is computed in terms of syllable-sized units. As an implication of this, Mehler and colleagues suggest that the lexicon is accessed via the syllable not via phonetic units. For a phonetic model, the words 'palmier' and 'palace' are still potential word candidates (in the same cohort) for Ss who have heard the sequence /pal/. In the syllabic hypothesis, however, these two words could be distinguished earlier because their syllabic structure furnishes more information that would otherwise be assumed. Drawing conclusions from these and other findings, Mehler et al present the syllable as a plausible candidate for on-line processing of the speech signal.

Developmental data are also available which suggest that the syllable is the natural unit of speech segmentation and processing. Despite the role it implicitly plays in the Jakobsonian frame of reference, only recently has the syllable been considered a possible perceptual unit for child language (see Moskowitz, 1973). It has been described by Mehler (1981) as a "useful device" for infants during language acquisition. Bertoncini and Mehler (1981) carried out research to assess the role of the syllable in the processing of speech in infants. Three kinds of stimuli were employed: syllabic, non-syllabic and syllabic synthetic sequences. Using a habituation-dishabituation paradigm [2] (ie a non-nutritive sucking technique with mean sucking rate calculated before and after a change), they presented stimuli to infants of six weeks or less. They reasoned that if infants are sensitive to natural syllables, they should consider a syllable like C_1VC_2 (eg [tap]) to be different from a syllable like C_2VC_1 (eg [pat]) though they should be indifferent to a similar physical change when it occurs in non-syllables such as $C_1C_xC_2$ (eg [tsp]) and $C_2C_xC_1$ (eg [pts]).

Results indicated that the syllable-like stimuli were discriminated better than the non-syllable stimuli even though the physical change from the habituation to the dishabituation stimuli was always the same. Put simply, infants displayed greater discrimination for well-formed syllables than for sequences of phonemes. They interpret the results as favouring a view according to which the syllable is the natural unit of speech segmentation and processing. If these results, in themselves, do not allow the authors to claim that the infant comes equipped with syllable templates or analyzers, at least they allow them to claim that infants distinguish between two possible syllables but not between two impossible ones even though the phonetic change is equivalent in both cases.

Another behaviour which provides evidence pointing to the primacy of the syllable is speech production. Syllables, rather than phonemes or segments seem to be 'articulatory primes'. Stutterers usually stutter and babblers usually babble in syllable-sized units (Linell, 1979). Similarly, false starts cannot be corrected before at least one syllable has been emitted (Linell, 1979).

Although evidence for the syllable as a moveable planning unit in speech errors is not strong, the evidence that it serves as a kind of framework for phoneme location is very strong. Shattuck-Hufnagel (1979) shows that there is a powerful position constraint on locations that phonemes can move into: they seem to move into permissible syllable positions, and they influence each other primarily from similar syllable positions.

Nooteboom (1969), also notes that errors generally obey the Parallel Syllable Constraint; segments only interact with segments in a parallel part of the syllable, ie onsets seem to shift with onsets, nuclei with nuclei and codas with codas. Furthermore, almost without exception, the error and the intended word have the same number of syllables (Fay and Cutler, 1977).

Some evidence from research in the "Tip of the tongue" phenomenon (TOT) provides a similar picture. This phenomenon arises when Ss recall suprasegmental properties of lexical items but cannot recall properties charateristic of the segmental level of representation. One such suprasegmental property is the number of syllables. Brown and McNeil (1966) found that a S in a TOT state can recall with significant success the number of syllables in a target he has not yet found. Similarly, Browman (1978) found that Ss were remarkably accurate in recalling the beginning or end of the word to be retrieved even when they could not produce the whole thing. Data from TOT studies have led Clements and Keyser (1983) to suggest that since the number of syllables presupposes syllabification, then words seem to be stored in fully syllabified form in the mental lexicon. They suggest that syllable trees may not be built up in the course of phonological derivations; rather, they may be already present fully formed, in the lexical representations that constitute the input to the phonological component (p 27).

In linguistic games (eg Sherzer, 1970, 1976; Swintramont, 1973) the most prevalent and permutable unit in transformations is the syllable. Swintramont, for example, discusses the Thai word game Khamphuan. In Khamphuan, everything is exchanged between the two syllables of a bisyllabic word except the initial consonant (eg ten+ram -> tam+ren 'dance'; wan+sug -> wug+san 'Friday'). Recently, de Reuze (1982) described a language game, Louzingi, used in Zaire, which was found to provide evidence for the location of syllabic boundaries (see Experiment four for more examples). Expletives (eg fan (bloody) tastic) also seem to be inserted in terms of the syllable (McCawley, 1978).

Yet more evidence for the use of the syllable comes from two sources: the evolution of writing and the acquisition of reading. Historically, syllabic systems were the first phonographies to be invented and, unlike the alphabetic system which was derived directly from the pre-existing syllabary, they recurred by independent invention and in different parts of the world. (Gelb, 1963; Gleitman and Rozin, 1977). The alphabet, it is thought, was invented only once. Furthermore, syllabary scripts have been shown to be readily mastered. For example, it has been claimed by Makita (1968) and Sekamoto (1980) that Japanese Kana [3] which is approximately a syllabary, is readily mastered by children, often without instruction. Because most of the graphic symbols in the Kana represent syllables rather than phonemes, it is claimed there is a low incidence of reading failure among Japanese children, since they rarely need to go below the level of the syllable in order to master the writing system (Makita, 1968).

Second language learning has also uncovered important facts about the syllable. Broselow (1983a, 1983b) and Anderson (1983) have shown how native language syllable structure constraints underlie pronunciation errors of second language forms. Broselow, for example, points out that the contrastive analysis hypothesis predicts two possible mispronunciations by native speakers of Arabic learning English of 'this ink', these being 'the sink' and 'this ?ink' on the basis of Arabic syllable structure assignment rules. She finds that only the second mispronunciation occurs. Broselow suggests that this is a consequence of the principle that universally permits syllabification on the domain of the word with insertion of the glottal stop before initial vowel.

Finally, recent research in neurolinguistics proposes a specific neuronal configuration for representing sublexical and lexical items (Sussman, 1984). Sussman proposes that there are neuronally-based templates for canonical syllable forms which are independent of segmental representations.

In sum, there are a number of lines of evidence from several speech behaviour sources which converge to suggest that the syllable plays an important role in phonological organisation. Such behavioural evidence reinforces the conclusion reached on the basis of more traditional linguistic evidence: that the syllable is a fundamentally relevant category in a phonological theory of the language. Perhaps because of the complex interactions of phonetics, phonology, morphology and orthography, however, definitions of the syllable based on strong native speakers' intuitions about this unit have yet to be developed.

In all events, there is much reason to suppose that the syllable or the syllabic unit is not only a formal category of linguistic organisation, but a cognitive reality as well, involved in the storage, perception, and produciton of speech. With the main purpose of the general study in mind, the aim of the experiments reported on here is to take this line of enquiry further and characterize the ability of native speakers to attend to the syllable in various metalinguistic tasks.

III Experiment 2

A. Background

As stated earlier, the present experiment was designed to determine the ability of the Ss to focus deliberately on and identify the syllable in word-initial position.

Data from some behavioural sources are interpretable as suggesting that the initial syllable in particular would be readily available for manipuation. Of more immediate relevance are findings from research in speech perception which suggest that the initial syllable is used to access the lexicon. For example, using a mispronunciation detection task, Cole (1973) and Cole et al (1980), have demonstrated the importance of the initial syllable in recognizing words in fluent speech. Ss listened to a passage in which mispronunciations had been implanted into either the first, second or the third syllable of three-syllable words. Each mispronunciation was created by changing a single consonant phoneme in the original version by either one, two, or four distinctive features. The changes were in the syllable-initial position in the first syllable and in the syllable-final positon in the second and third syllables. It was predicted that the more features that were changed in the pronunciation, the more likely the Ss were to detect the change, regardless of the syllable in which it occurred. However, when a sound was changed by only one feature, Ss were much less likely to detect the error if it was embedded in either the second or the third syllable. Furthermore, Cole (1973) found that detection of a mispronunciation was slower when it occurred in the first syllable of a word than when it was in a later syllable for all three types of feature changes. The data were accounted for by assuming that the word is accessed on the basis of its initial syllable. If a mispronunciation occurs in the first syllable, rather than in the second or third syllable, detection tasks take a long time because S must search through a section of his lexicon consistent with the mispronounced syllable until it is clear that there is no lexical entry with that pronunciation. When the error occurs in either the second or the third syllable, it is likely that S will have already accessed the word via its first syllable by the time the last two syllables occur.

Similar findings were obtained by Marslen-Wilson (1975) using shadowing tasks. Ss almost never restored mispronounced phonemes when these occurred in the initial syllable of a word. However, when mispronunciation occurred in the second and third syllables of words, these were restored. These restorations were often so fast that a shadower might begin to say the correct word (eg company) before the second syllable of the mispronounced word (eg campsiny) has begun. Put another way, if mispronunciation occurs before the word has been completely identified, the mispronunciation will be reproduced. Otherwise it will not.

Further supportive evidence for the role of the initial syllable in lexical access comes from another experiment by Marslen-Wilson and Welsh (1978). Following Morton and Long (1976), they have shown that differing amount of constraint on detection of mispronunciation also affects performance in the shadowing task. Ss were much more likely to restore a mispronounced phoneme in a word that was highly constrained by the previous sentence context (51.0%) than when it was a word that was less constrained (41.1%). Of importance here, is the fact that regardless of the amount of contextual constraint, fluent restorations were still more likely in the third syllable than in the first syllable of the mispronounced word.

Mehler et al (1981) have argued that even in a 'cohort' type model (Marslen-Wilson and Tyler, 1980) [4] which generally assumes that left to right phoneme sequences determine how and when the listener can make an access to his lexicon, the initial syllable was found to be used to access the lexicon.

Finally, Taft and Foster (1976) and Foster (1979), dealing with lexical storage and retrieval of polymorphemic and polysyllabic words, proposed that it is the initial syllable of a word's root which actually forms its access entry in the internal lexicon. They found, for example, that lexical decisions on compound nonwords took more time for those which began with words than for those which began with nonwords, regardless of the lexical status of the second constituent. Evidence was provided that access is achieved through the initial syllable in noncompound words as well: a nonword which was the first syllable of a word (eg plat) took longer to classify than did a control (eg pren). A stimulus string's status as the final syllable of a word did not, however, affect its lexical decision time. This finding suggests that only the initial syllable is involved in lexical access. Put another way, the initial syllable of a word is its access code.

From the behavioural sources examined above, it would appear that the initial syllable in particular might be readily available for manipulation in a metalinguistic task such as the one at hand. The procedure is described further below. First, we describe the design and materials. In particular, we discuss the rationale for exploring certain linguistic variables and making predictions about their effect on the task.

B. Method

1. Design

The design of the experiment allowed the examination of three linguistic variables that appeared likely to have an effect on Ss' ability to perform the task. One such variable, it was hypothesised, would be the number of syllables in a stimulus word (Length variable). Theoretically at least, the fewer syllables comprising a word, the more likely it should be that segmentation leading to the extraction of one initial syllable would be easy, other things being equal. Findings by Mills (1980) suggest that Ss may find it easier to determine syllables that are lexical entries (eg 'can'), from syllables that are part of a long word (eg 'candy'). He shows that when a one-syllable utterance is presented in isolation it is responded to faster when that syllable is given as a target that when the same syllable is part of a two- or a three- syllable word. Thus, when Ss are given /can/ as a target, they respond to the word 'can' faster than to /can/ in the words 'candlelight' or 'candle'.

Thus, we hypothesize that among the experimental stimuli, one-syllable words should be less problematic in the sense that they might require less analysis than longer words. Further support for this hypothesis comes from research in word recall. In list recall, amount of phonological information in a word may affect the probability that it will be recognised. For example, Kintsch (1972) found that while there was no correlation between length in letters and recall errors, a significant correlation was found between length in syllables and recall errors. Research in TOT (Rubin, 1975) also indicates that not only can phonological representation of words be decomposed into units that may be independently retrieved, but that the fewer units a word contains, the more likely it should be that retrieval will be complete.

A second variable that was predicted to have an affect on performance was the stress pattern of stimuli. It has often been noted in studies dealing with the problem of segmentation and recognition of words that syllables bearing primary stress [5] are longest; loudest and possess the great clarity (Adams and Munro, 1978; Bradley, 1980; Wanner and Gleitman, 1983). In the words of Cutler (1984), "stress is not merely information which becomes available on access of a word's lexical entry, but it is of use to guide (emphasis in text) lexical access, ie enable only those entries with appropriate stress patterns to be fully accessed" (p 81). In a study by Shields et al, (1974), Ss were found to be able to detect target phonemes more rapidly in syllables which are actually stressed. Because of such findings, it was expected that stressed initial syllables would be more easily identified than unstressed.

The third and last variable is related to the internal constituent structure of the initial syllable. Following Snowling (1981) and Mehler (1981), it was reasoned that as the sizes of its terminal consonant clusters (ie its coda) increased, the initial syllable would become more difficult to extract. Examining the effect of 'phonological complexity' on reading, Snowling suggests that words containing single consonantal sounds (eg CVC) were less complex than words containing one or more consonantal sounds (eg CC V C) and therefore less problematic. Accordingly, the present experiment included CVC (C) and (C) CV syllable configurations.

2. Materials

Thirty six experimental words of varying length and syllabic structure were selected such that there were two parallel sets each containing 18 stimuli. Thus, half the Ss in each sample received one set, and the other half the second set. An additional six words common to both sets were used as practice stimuli. The test stimuli were randomised with respect to the number of syllables in each stimulus word with all the Ss encountering the same random order within each set. The words employed were all assumed to be familiar to the younger Ss [6]. A full list is to be found in Appendix B.

In order to allow assessment of the effects that the relevant linguistic variables might have upon performance, the materials were designed as follows:

(i) The stimuli consisted of one-, two- and three- syllable words. Each set contained six stimuli of each length.

(ii) Half the stimuli received primary stress on the initial syllable, and half on their second syllable [7].

(iii) Each initial syllable was based on a CV structure and the sizes of the initial (onset) and terminal (coda) consonant clusters were varied systematically [8]. Thus, each set contained nine (C) CV and nine (C) CVC (C) syllable types, three of which were ambisyllabic, ie clusters of two identical consonants occurring medially due to the presence of gemination [9].

3. Procedure

The procedure was presented as a game in which only the first syllable of a word was to be given. The technique employed to elicit responses is explained below. Ss were presented orally with 18 stimuli each, one at a time. All stimuli were spoken by E at a normal rate (ie there were no pauses between syllables comprising the words). A word was repeated once if requested.

During the pretest session, Ss were given sufficient practice to ensure that they were familiar with the game. In addition to the six practice words representing the length types represented by the stimuli used in the test, Ss' own names were also used as practice items. The use of of Ss' own names was compatible with the elicitation technique which will be disucssed in more detail below. During this phase, feedback was provided on all trials, but none was provided during the final phase.

3.1 Elicitation Techniques

As noted earlier in the introduction to this chapter, the present study makes a contribution to the methodology of identification of linguistic units in metalinguistic tasks in presenting a new type of elicitation technique. Because this technique (or versions of it) was also employed in other experiments in the present study, the purpose of this section is to explain and justify it.

It will be recalled from Chapter 1 that most techniques employed to explore phonological awareness have been replications or at best modifications of the Liberman et al (1975, 1977) paradigm which uses tapping to mark the number of syllables or phonemes in an utterance. Briefly, the Liberman et al's technique requires Ss to indicate the number of units in a sequence of sounds (usually isolated words) by tapping a wooden dowel on a table once for each unit perceived. In the syllable segmentation test, Ss might hear 'happy' and would have to tap twice; in the segment (or phonemic) test, they might hear 'this' and would have to tap three times. Findings based on children's performance indicated that the phoneme was the more difficult.

As far as it goes, this technique has some virtues. At the least, it shows that children can indeed perform a syllable counting task, although in varying degrees of success. However, there are also problems with it. An important one is that while it may reveal something about the syllable, it does not, on the other hand, show much about the segment. The reason for this is very simple. Tapping is essentially a rhythmic task. The rhythm of a word is captured in its syllables, not its segments. Thus, the relative ease of a syllable counting task at the expense of the segment may have nothing to do with the nature of either the syllable or the segment. It may be due to the rhythmic motor response of tapping a dowel which may not be intrinsically compatible with the location of phonological segments (see Bryant, 1982; Treiman and Baron, 1981; Bryant and Bradley, 1985). A further problem with this technique is that it does not guarantee that S knows what a syllable or segment is, only how many there are: No segmentation takes place.

Another technique which has apparently been used with some success, was developed and used exclusively by Fox and Routh (1975). This technique involves asking three-and-a-half to six-year-old children to "tell me just a little bit of what I said" (a sentence presented to them by the experimenter). Thus, given 'Peter came', for example, the children would repeat "Peter" or "came" and then "Pe" etc... When the child responds with a phrase, E repeats the phrase prompting the child to say just "a little bit of it".

There are at least two problems with this technique, one minor and one major. The minor problem is that it requires children to understand the instruction "tell me just a little bit of what I said". As our pilot work revealed, this instruction was too complicated for the children we tested to follow. In response to this request, one child (age 4; 10) said "how much little (sic) do you want?" One wonders how three-and-half year-old-children like Fox and Routh's Ss would interpret the instruction [10]. A major problem follows as Ehri (1979) also pointed out. It is doubtful whether the child's response can be regarded as a manifestation of words, syllable or phoneme awareness since E continued asking for further segmentation and it was E again who decided when the segmentation at any given level, was complete. For example, when a child's response was "the book" for word segmentation, he was prompted by E to say only a little bit of it until he successfully produced "the" or "book".

The technique employed in this and other experiments in the present study seems to circumvent the difficulties discussed above. The paradigm takes the form of a modified knock-knock game.

3.2 The Knock-Knock Game Technique

Typically, the true knock-knock form represents a small formalized five-line dialogue with some fixed elements that are readily apparent. A typical knock-knock is the following:

1. Initiator : Knock-knock
2. Victim (?) : Who's there?
3. I : Olive
4. V : Olive who?
5. I : Olive you = I love you

Lines one and two (the elicitation summons 'knock-knock' and the response 'who's there?') are constants. Line three is the first variable element, a response to the 'who's there?' of line two. Line four, while not constant, has a clear and simple rule. Line three plus 'who?'. The basic form in line five always involves a transformation of line three plus other elements, but there are several ways of accomplishing this which need not concern us here.

The modified knock-knock game used as an elicitation technique in the present experiment is 'initiated' by S using the stimulus assigned to him by E. The routine proceeds thus:

E proposes a word (eg Samira)
1 S knock-knock
2 E who's there?
3 S Sa----- S gives initial syllable only. This is the response which is scored.
4 E Sa----- who?
5 S Samira

The main advantage claimed for this procedure is that it actually requires Ss both to identify and extract the unit which E sets as a target in each run. A second advantage is that it enables E to assess the ability of S to locate boundaries of syllables. It is versatile enough to be employed with different units and different tasks, as indeed it has been in the present study. A further claim for this procedure is that the game is suitable for both children and adults. Finally, by implicitly requiring Ss to repeat the stimulus word, line five of the game (final line) ensured that S had not misheard or misremembered the stimulus word.

C. Results and Discussion

1. Subject Variables

1.1 Scoring and Data

A response was accepted as correct when the initial syllable was extracted [11]. The number of initial syllables which were correctly identified was calculated for each S and each category of stimulus and subsequently converted to percentages. The means and standard deviations for each age and literacy group are displayed in Table 5.2.1 below.

		LITERACY			
		Literate		Illiterate	
AGE	CHILD	54.78	(14.06)	58.02	(21.69)
	ADULT	72.21	(12.17)	55.47	(21.84)

EXPERIMENT 2 - Table 5.2.1: Mean percentage correct initial syllable extraction as a function of Age and Literacy. Standard deviations are in parentheses.

1.2 Analysis and Findings

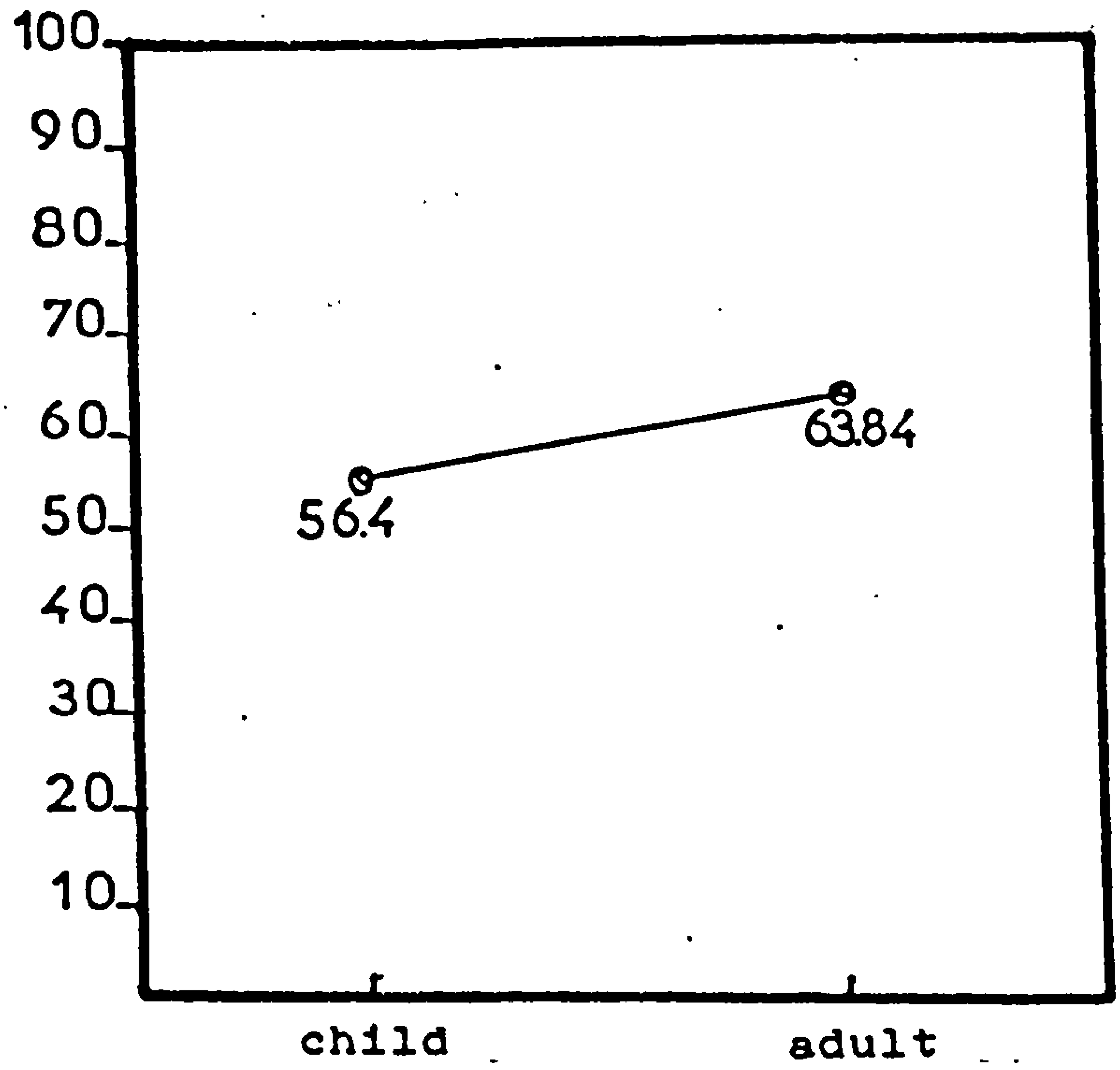
Two statistical methods were employed. The first method was an ANOVA for the overall data generated by all Ss, and the second one a Pearson Product Moment correlation for Task Score by Age and Task Score by Grade performed on the child data only.

1.2.1 ANOVA. Raw scores were submitted to two separate ANOVA's, one by Ss and one by materials. Both analyses used a 2(Age (Child, Adult)) x2 (Literacy (literate, illiterate)) x2 (Group (A, B)) design.

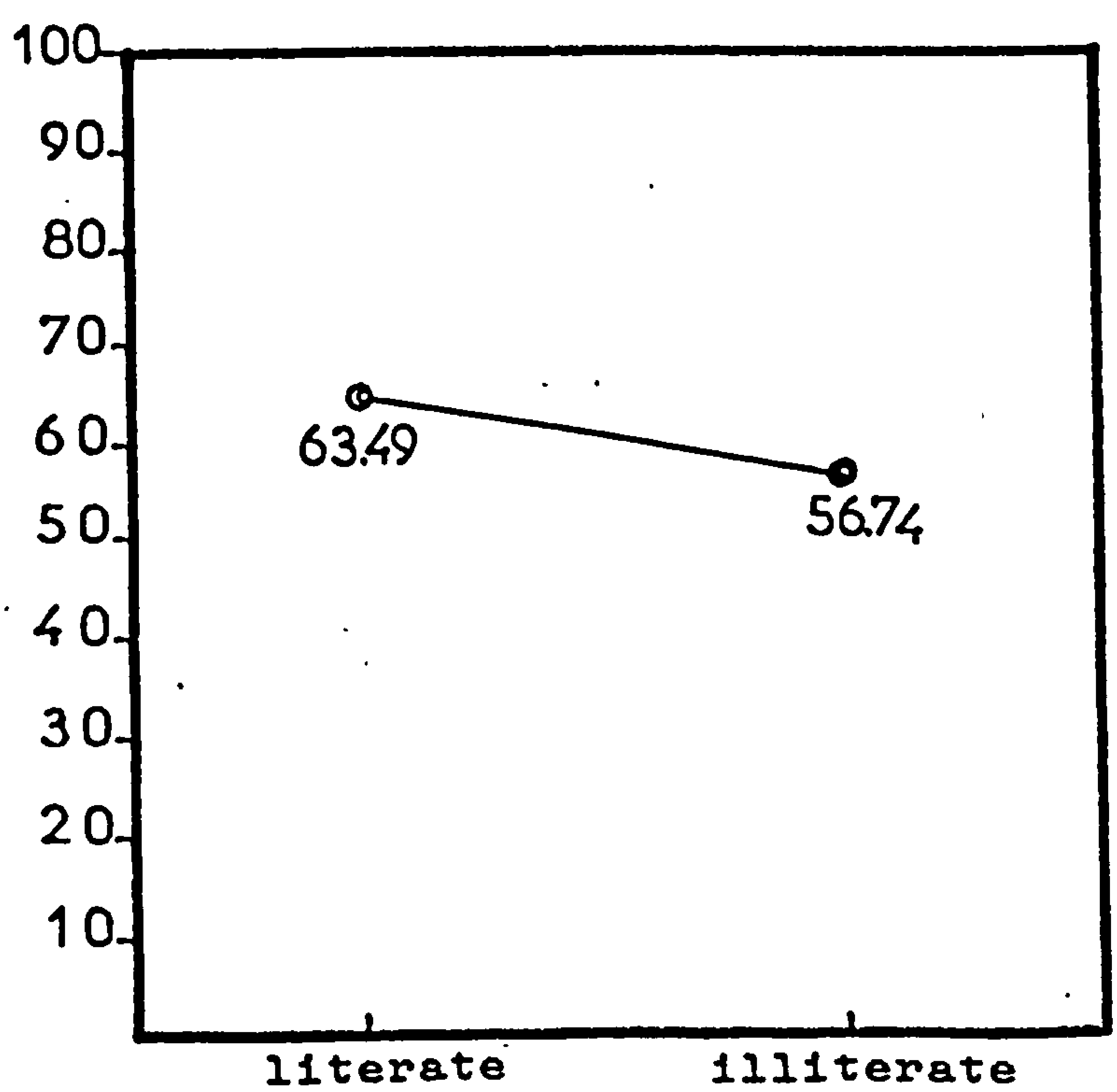
As plotted in Figure 5.2.A, the main effect of Age, though significant both by Ss (F_1 (1,112) = 4.81,p <.03)) and by materials (F_2 (1,34) = 8.57,p <.006)), did not attain statistical reliability when both F values were combined (min F' (1,37) = 3.08,p >.05). Means for the child and adult Ss were 56.4% and 63.84%, respectively.

The main effect of literacy was no more consistent than that of Age.Results indicated that while it was moderately reliable in the by-materials analysis (F_2 (1,34) = 5.37,p <.02), it was only marginally reliable in the by-Ss analysis (F_1 (1,112) = 3.95,p <.049). Not surprisingly, min F' did not reach significance (min F' (1,124) = 2.27, n.s). Means were 63.49% for the literates and 56.74% for the illiterates. Figure 5.2.B illustrates these results.

Overall, these data indicate that the adults' performance was better than that of the children as was that of the literates over the



Experiment 2 - Fig. 5.2.A: Mean percentage correct responses as a function of age



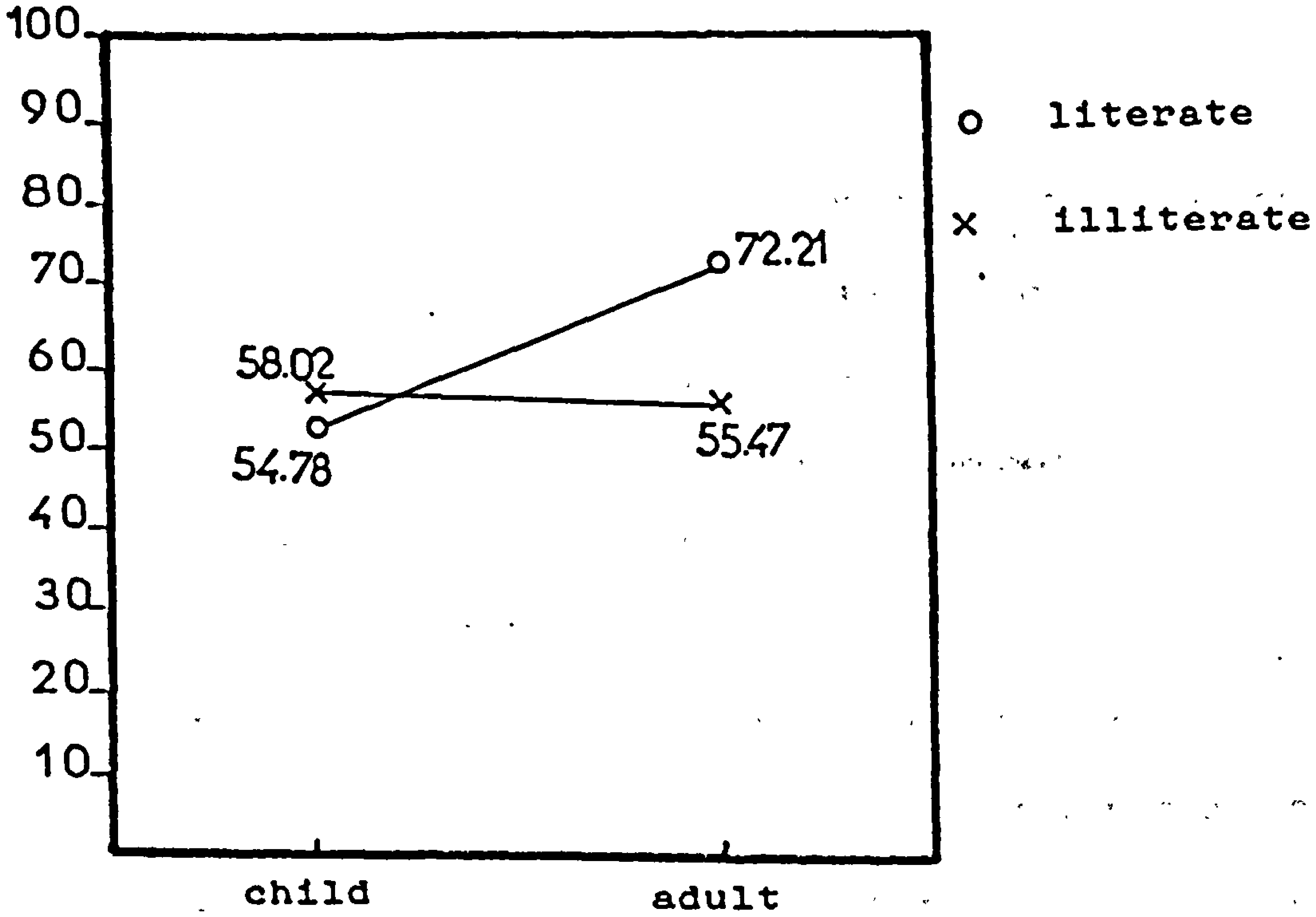
Experiment 2 - Fig. 5.2.B: Mean percentage correct responses as a function of literacy

illiterates, thus suggesting that the ability to identify the initial syllable increased with both Age and Literacy.

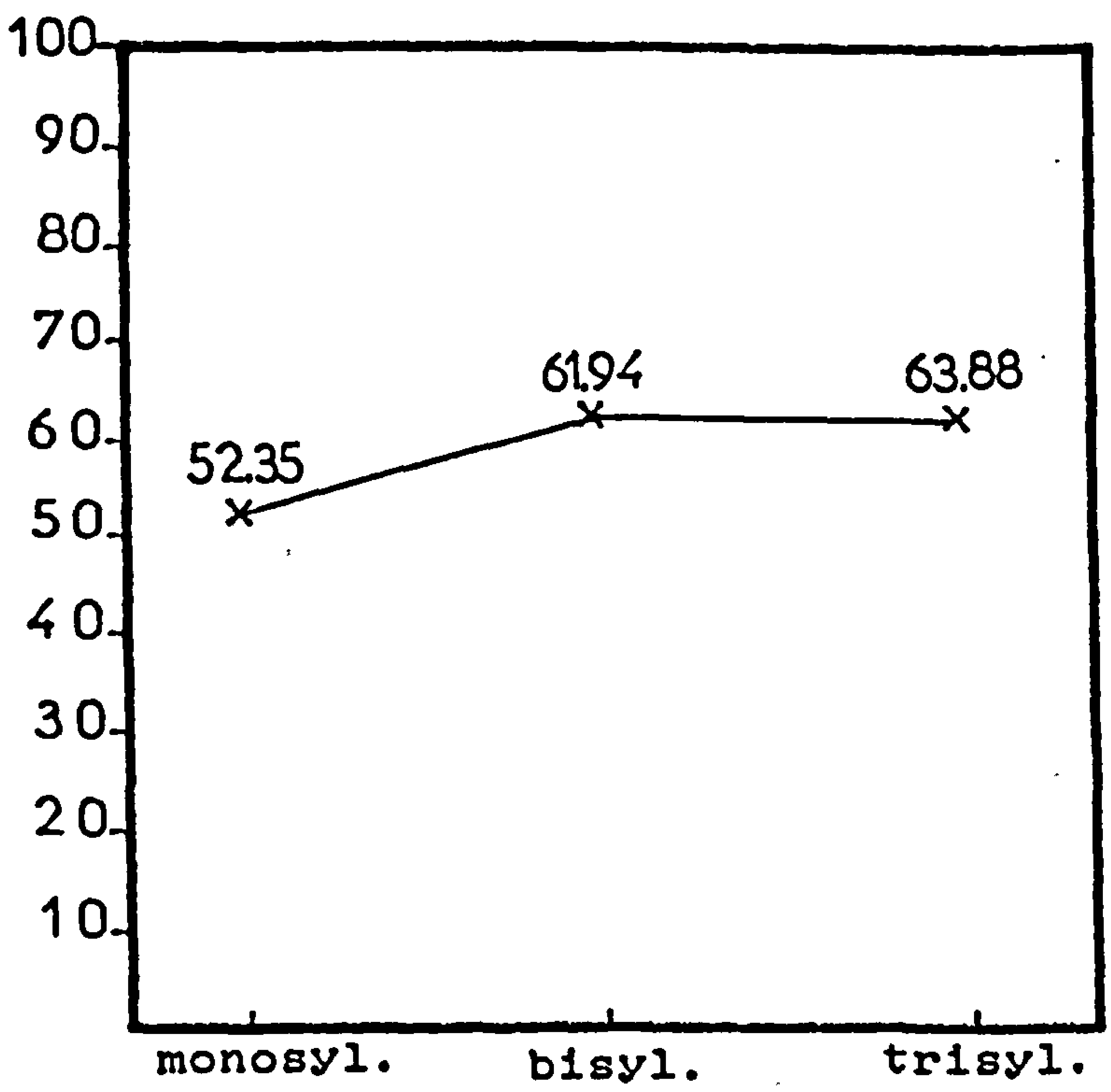
These results, however, were qualified by the presence of an interaction between the two factors of Age and Literacy. The interaction was highly significant both across Ss (F_1 (1,112) = 8.66, $p < .004$) and stimuli (F_2 (1,34) = 8.64, $p < .005$), yielding a reliable min F' (1,110) = 4.32, $p < .05$).

As Figure 5.2.C indicates, the literacy effect was more marked in the adult Ss than in the child Ss, whereas the effect of Age was more marked in the literate Ss than in the illiterate Ss. A closer examination of the data revealed that there was little, if any, difference between the two groups of children ($\bar{X}$ = 56.4%) and the illiterate Adults ($\bar{X}$ = 55.47%) or between the two groups of illiterate ($\bar{X}$ = 56.74%) and literate ($\bar{X}$ = 54.78%) children. Only the literate adults scored particularly high. In fact, it was the literate adults who made the grand mean for the literate ($\bar{X}$ = 63.49%) and the adults ($\bar{X}$ = 63.84%) higher than that for the illiterates and the children, respectively.

The Age x Literacy interaction was further explored by post-hoc Scheffé procedures which disclosed significant diffrences (at $p < .05$) between the literate adults and each of the remaining groups who did not differ significantly from each other. Thus, the presence of the interaction could be safely interpreted as being entirely attributable to the superior performance of the literate adults.



Experiment 2 - Fig. 5.2.C: Mean percentage correct responses as a function of age and literacy



Experiment 2 - Fig. 5.2.D: Mean percentage correct responses as a function of length of stimuli

1.2.2 Correlations. First order correlational tests were employed to determine the three-way relationship between the children's chronological age, level of literacy and performance on the initial syllable identification task. The aims and procedures are similar to those used in Experiment 1 and will not be discussed here.

The two most relevant correlations, Age x Task score and Grade x Task score were found to yield very small, indeed negligible coefficient indexes whether all the children ($r_{\text{Age x Task}} = 0.03$ and $r_{\text{Grade x Task}} = 0.09$) or only the literate ones ($r = 0.10$ and 0.03) were examined. In view of the small tolerance (ie the magnitude of the contribution of the variables Age and Grade) no partial correlations were performed. Means were 58.02% for illiterate children, 55.85% and 53.69% for grade 1 and grade 2 literate children, respectively.

These results clearly indicate that there was no increase in children's performance with either age or level of literacy. Furthermore, they also show that there was no change in performance from first to second grade when only the literate children were considered (ie there was no relationship between degree of literacy and performance). As subsidiary tests, they also confirm the major overall ANOVA finding reported on earlier, namely, that individually, the effect of Age and Literacy were not convincing and that the Age x Literacy interaction was essentially caused by the literate adults' performance.

To summarize the overall results so far, they do not unequivocally indicate that performance was determined solely or even mainly by either age or literacy factors. Thus, while both effects were found, they were much weaker than in Experiment 1. In fact, neither min F' was found to be reliable. Instead the Age x Literacy interaction indicated that the task did not clearly distinguish children from adults, or literates from illiterates. Rather, it showed that the literate adults outperformed the remaining groups which did not differ. Age seems to be an important factor only when it correlates with markedly increased literacy.

These results were further illuminated by correlation tests performed on the child data which revealed only the most negligible relationship between either chronological age and performance or literacy level and performance.

2. Linguistic Variables

So far we have been focusing on factors within Ss that affect their ability to attend to the initial syllable. In this section, we examine the factors within stimuli that appeared likely to have an effect on Ss' ability to perform the task.

As evident in the Design section, the present experiment allowed for examining three linguistic variables, namely: (i) the length of the stimuli as measured by the number of syllables comprising each stimulus word (length factor); (ii) the type of the target syllable used as measured by whether it was open or closed (syllable type factor) and (iii) the stress pattern of stimuli measured by whether the initial syllable was stressed or unstressed (stress factor).

2.1 Analysis

To assess simple effects of the relevant linguistic variables and their interactions with subject-variables, two separate ANOVA's (one by-Ss and one by-materials) were conducted for each one of them. In the by-Ss design, Ss were nested in Age, Literacy and Group and crossed with stimulus type. In the by-materials design, stimuli were nested in stimulus type and crossed with Age, Literacy and Group. Thus, the four-factor design for the first linguistic variables was 2(Age (Child, Adult)) x 2(Literacy (Literate, Illiterate)) x 2(Group (A, B) x 3(Length (monosyllabic, bisyllabic, trisyllabic)).

The designs for the second and third linguistic variables were similar to the above design with the exception that they had only two levels (Open v Closed and Stressed v Unstressed) for each one of them, respectively.

The by-Ss designs used raw data representing the proportion of correct responses obtained by each S in each one of the stimulus types, whereas the by-materials designs used the mean percentage of correct responses obtained from the scores for all Ss responding to each stimulus type.

2.2 Effect of Length

As evident in Table 5.5.2, it can be seen that the effects were not in the predicted direction. In fact, there was a tendency for Ss to perform worse on monosyllables ($\bar{X}$ = 52.35%) than on the other two types which did not appear to differ ($\bar{X}$ = 61.94% v 63.88% for bisyllabic and trisyllabic words, respectively). This is even more surprising when we realise that bisyllabic stimuli are half initial stressed while trisyllabic are never initial stressed (but seen Footnote 7).

	LENGTH					
	Monosyllabic		Bisyllabic		Trisyllabic	
CHLIT	42.12	(24.35)	61.10	(24.63)	61.10	(29.34)
CHILT	47.25	(26.63)	60.64	(25.92)	66.20	(33.16)
ADLIT	76.38	(15.54)	72.94	(19.28)	67.36	(25.85)
ADILT	57.62	(28.09)	54.89	(24.99)	59.90	(30.52)

EXPERIMENT 2 - Table 5.5.2: Mean percentage correct responses as a function of Age, Literacy and Length of stimuli (one-, two-, three-syllable stimuli). Standard deviations are in parentheses.

These observations were confirmed by the ANOVA results. They revealed a significant main effect of length (F_1 (2,224) = 5.10, $p < .006$) with initial syllables more successfully identified in bisyllabic and trisyllabic words than in monosyllabic ones. This effect, did not, however, generalise across stimuli (F_2 (2,30) = 0.98, n.s). This result is plotted in Figure 5.2.D.

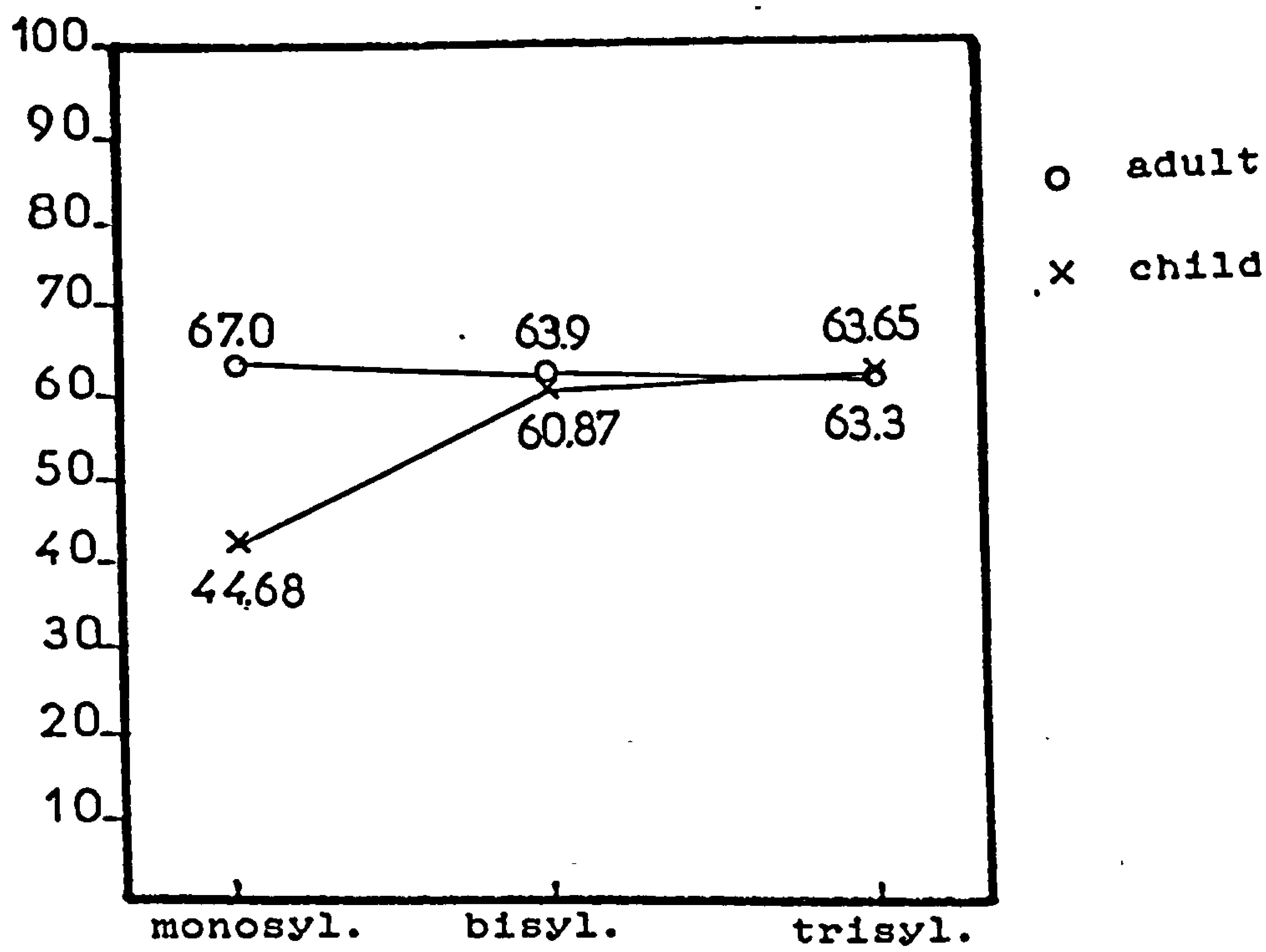
The only interaction to reach significance in both by-Ss and by-materials was the one between Age and Length (F_1 (2,224) = 5.41,p <.005; F_2 (2,30) = 8.98,p <.0009); min F' was also reliable (min F' (2,155) = 3.37,p <.05. Means for children and adults were 60.87% v 63.90% for bisyllabic stimuli and 63.65% v 63.63% for trysillabic stimuli.

The absence of a literacy x length interaction and the moderately high scores suggests that regardless of whether they were literate or not, Ss were sensitive to the number of syllables in the stimulus word. However, the presence of the Age x Length interaction suggests that the robustness of the main effect in the by-Ss analysis must be qualified. As can be seen in Figure 5.2.E, the Age x Length interaction arose mainly from the fact that children's performance varied with the number of syllables in stimulus words. Specifically, on monosyllables children failed to perform as well as adults or as all Ss did on two- and three-syllables. In fact, both age groups performed equally well on bisyllabic and trisyllabic stimuli. Age differences were observed only for performance on monosyllabic stimuli when children were at a disadvantage (X = 44.68% as compared to 64%) whereas adults seemed to be no less able to perform correctly when the initial syllable was itself a word than when it was part of a two- or three-syllable word. Post-hoc Scheffé tests disclosed that performance by children and adults differed significantly (p <.05) only for the monosyllabic stimuli but not for the other two length types.

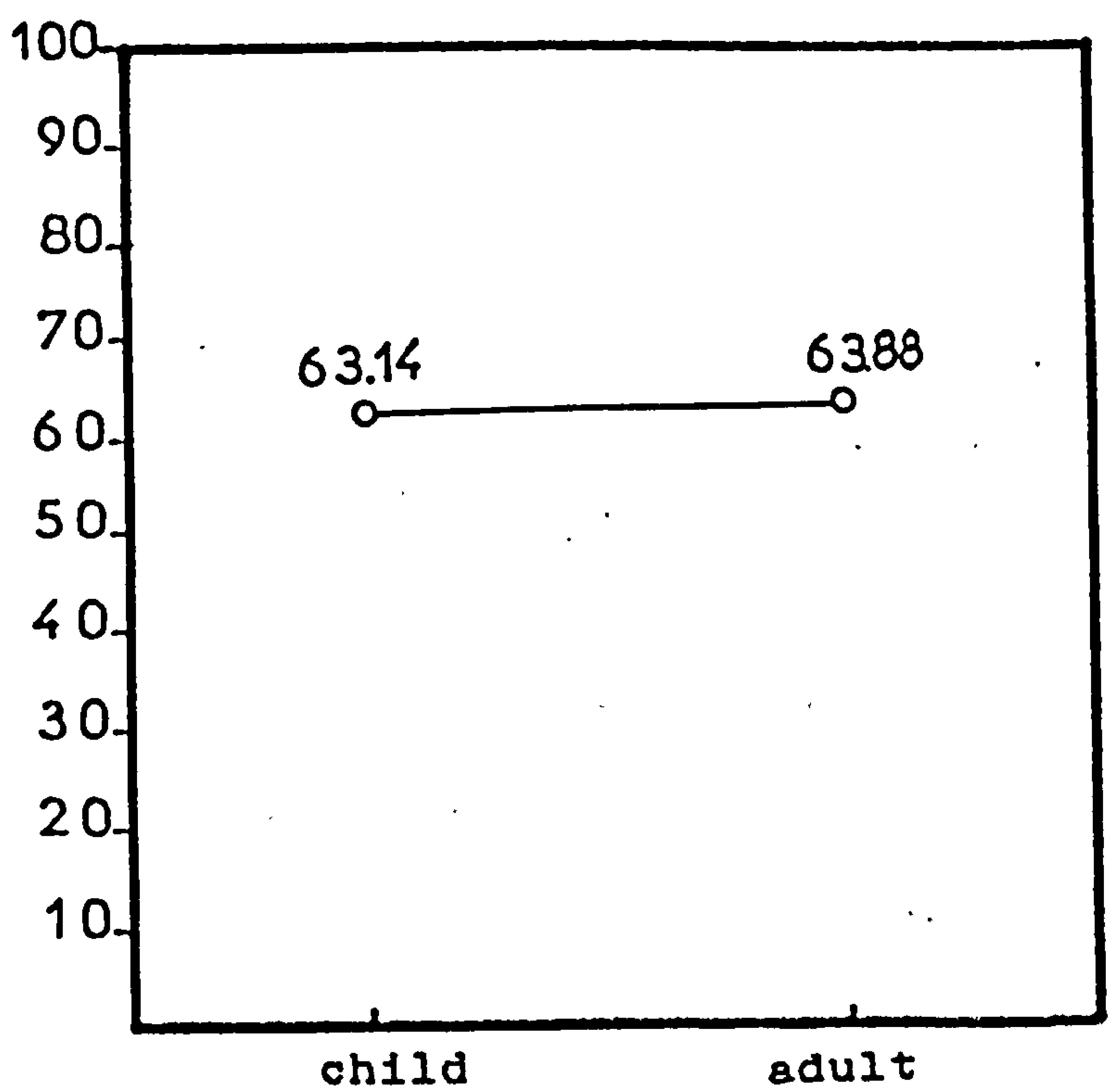
As observed earlier, these effects were not in the predicted direction. While we cannot produce a principled explanation for this finding, two possible reasons come to mind. First, it might be that children view the syllable as a meaningless unit which must always be part of but smaller than a meaningful word, and therefore were led to segment the monosyllabic stimuli further to yield a 'syllable'-sized unit. Put another way, it might be that for children, a syllable cannot also be a meaningful word. Although the data at hand cannot rule out this possibility, we think it unlikely. Children's performance on the other two length types clearly indicates that their concept of the syllable seems to be like that of the adults. Also the fact that both groups of children performed equally poorly on monosyllabic stimuli, when we would have expected the literate ones to perform better, is another indication that there may be another factor here.

The second and more probable explanation for this effect is a nonlinguistic test artifact. Indeed, if we accept the idea that the task required Ss to respond with a sub-part of an utterance, then a case could be made that children were inclined toward making a segmentation even when one was not necessary.

In order to discount the artifactual effects, a reanalysis of the data was performed excluding scores obtained for the monosyllabic items (see Table 5.2.3 below).



Experiment 2 - Fig. 5.2.E: Mean percentage correct responses as a function of age and length of stimuli

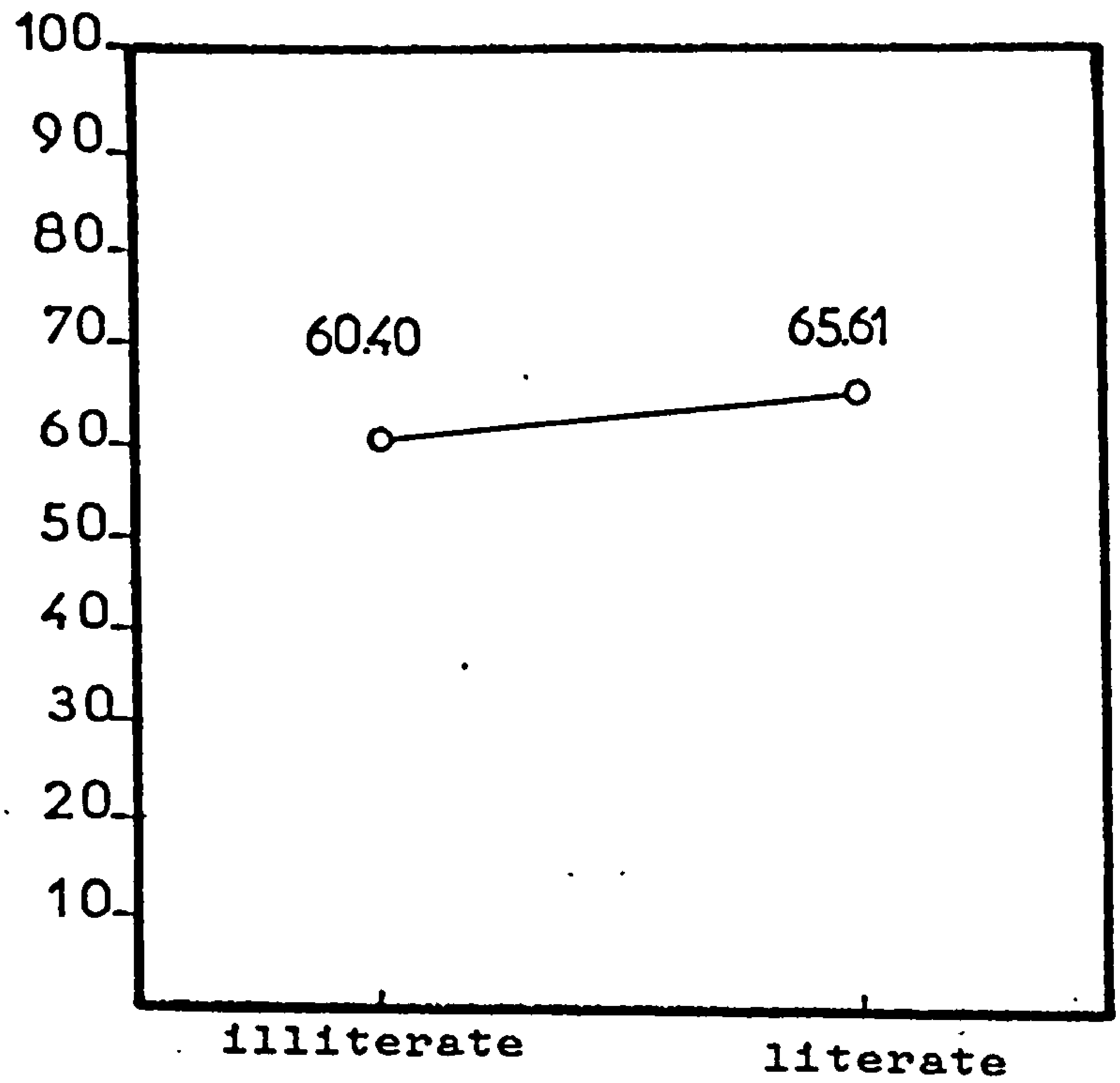


Experiment 2 - Fig. 5.2.F: Mean percentage correct responses as a function of age (excluding scores for monosyllables)

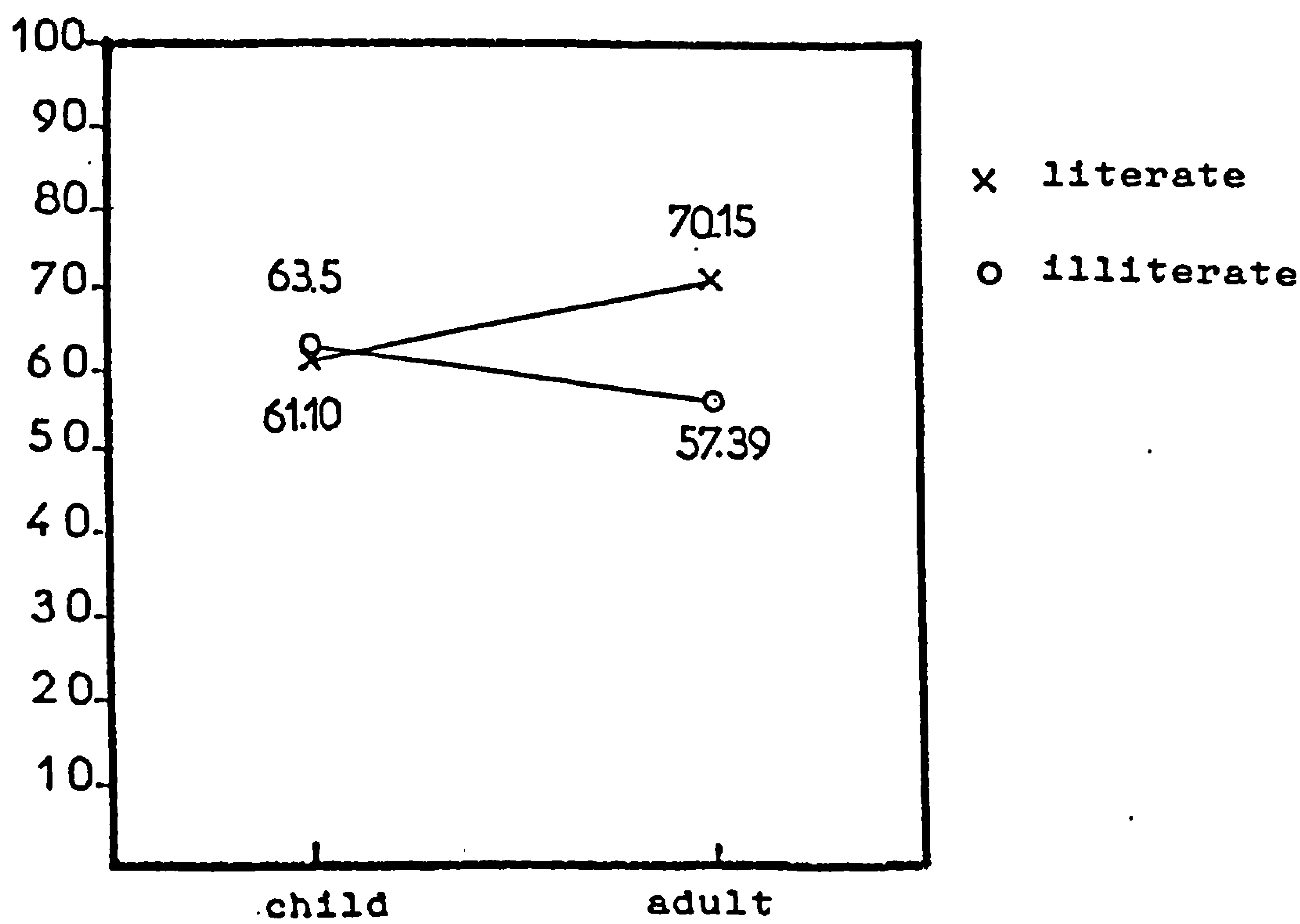
		LITERACY	
		Literate	Illiterate
AGE	CHILD	61.10	63.42
	ADULT	70.15	57.39

EXPERIMENT 2 - Table 5.2.3: Mean percentage of correct responses excluding monosyllables for each age and literacy group.

On this occasion, although the literate adults still scored higher than the other groups, none of the main effects of Age, Literacy or Length was found to be reliable. Similarly no significant interaction was recorded. Means for children and adults were almost identical (63.14% and 63.88%, respectively; F_1 (1,112) = 0.17,p >0.67; F_2 (1,22) = 0.27,p >0.61). Means for the literates and illiterates were 65.61% and 60.40% (F_1 (1,112) = 1.56,p >0.21; F_2 (1,22) = 1.89,p >0.1). Even the strong Age x Literacy interaction that emerged in the previous analysis failed (F_1 (1,112) = 3.06,p >0.08; F_2 (1,22) = 2.35,p >0.1). Means were 61.10% and 70.15% for the literate children and adults, respectively, and 63.5% and 57.39% for the illiterate children and adults. For purposes of comparison with the findings from the original analysis, results for the effects of Age, Literacy, and their interactions are illustrated in Figures 5.2.F, 5.2.G and 5.2.H.



Experiment 2 - Fig. 5.2.G: Mean percentage correct responses as a function of literacy (excluding scores for monosyllables)



Experiment 2 - Fig. 5.2.H: Mean percentage correct responses as a function of age and literacy (excluding scores for monosyllables)

2.3 Effect of Syllable Type

The second linguistic variable which was hypothesised to cause variance in performance was the internal structure of the target syllable itself. Specifically, it was expected that open syllables would lead to better performance than closed syllables.

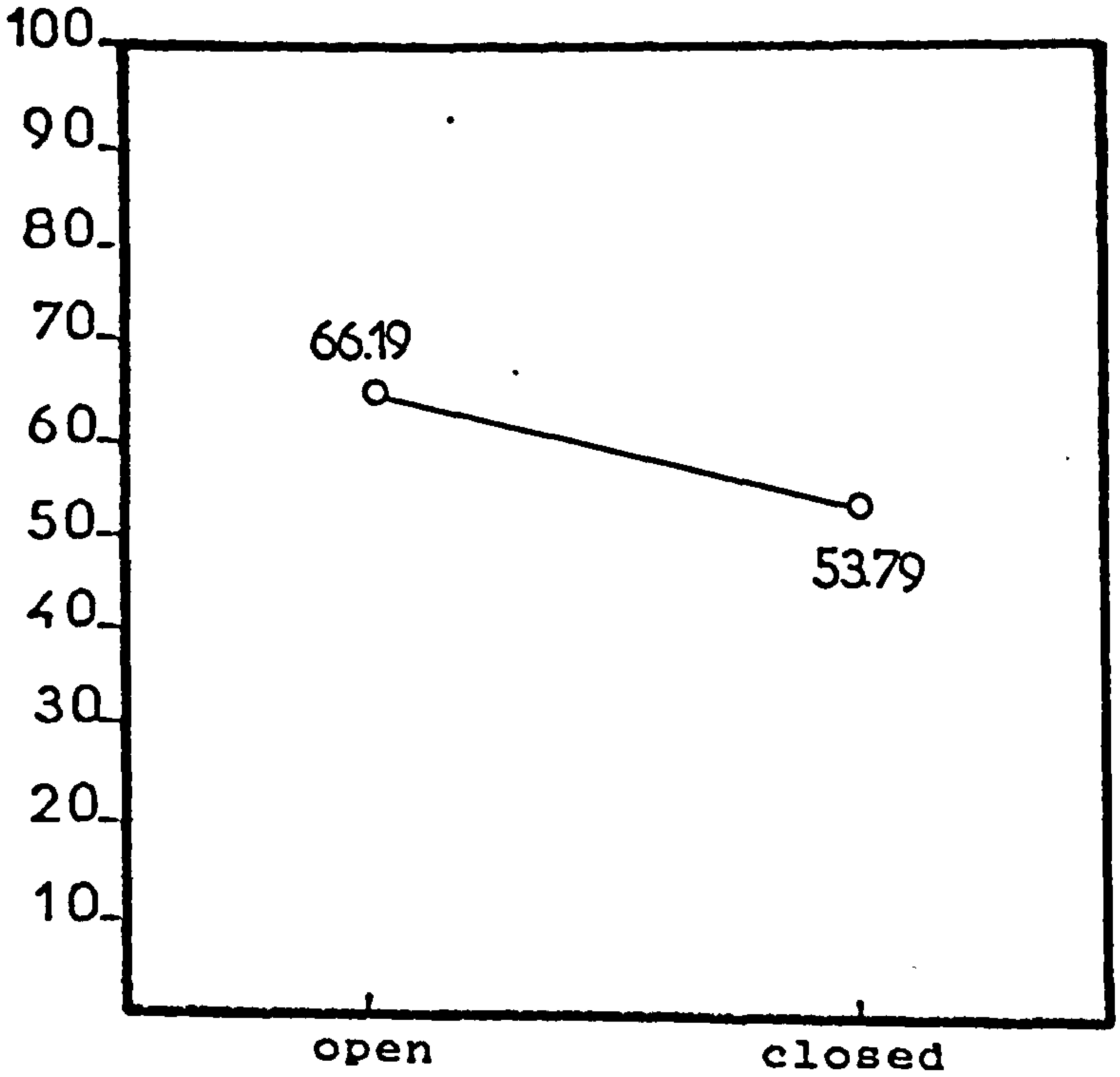
A visual inspection of the data shows this to be exactly what happens. As can be seen in Table 5.2.4, performance varied with the nature of the initial syllable. Thus, there was a general tendency to identify initial syllables correctly more often when they were open than when they were closed ($\bar{X}$ = 66.19% v 53.79%). This difference was found to be highly reliable by Ss (F_1 (1,112) = 19.96,p <.0001), but not by materials (F_2 (1,32) = 0.09, n.s) (see Figure 5.2.I).

	SYLLABLE TYPE			
	Open		Closed	
CHLIT	63.79	(20.83)	44.55	(24.95)
CHILT	63.69	(24.28)	52.77	(24.98)
ADLIT	70.83	(20.64)	72.73	(16.16)
ADILT	66.24	(20.56)	45.13	(30.02)

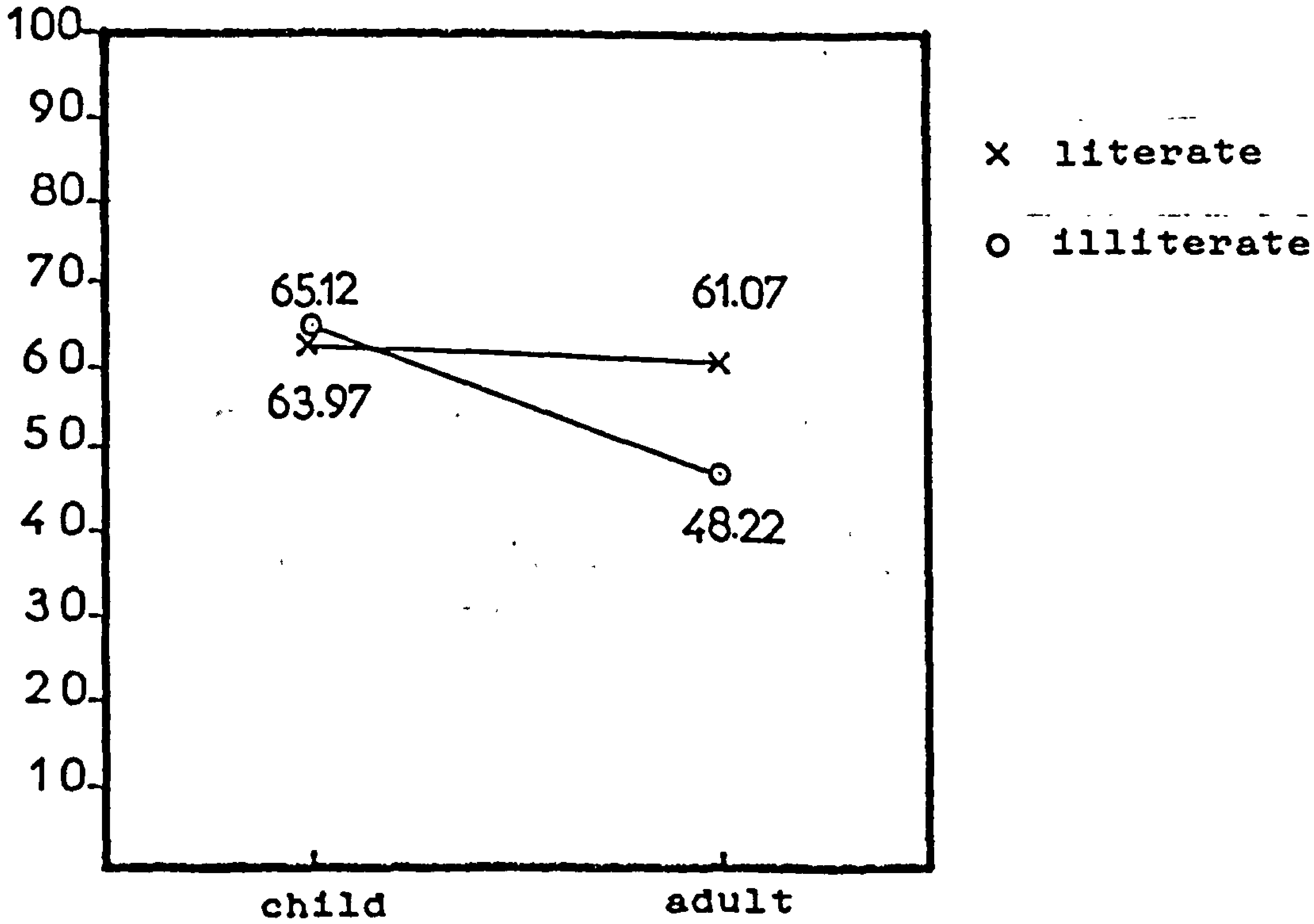
EXPERIMENT 2 - Table 5.2.4: Mean percentage correct responses as a function of Age, Literacy and Syllable Type (open syllable v closed syllable). Standard deviations are in parentheses.

While the interaction between Age and syllable type did not even reach an F of 1 in either analysis, the one between literacy and syllable type was significant, though only by materials (F_2 (1,32) = 6.00,p <.01). The literacy x syllable type interaction was essentially caused by the fact that the illiterates' performance varied with whether an initial syllable was open or closed ($\bar{X}$ = 65.12% for open as compared to 48.22% for closed), whereas the literates performed similarly on both stimulus types ($\bar{X}$ = 63.97% for open as compared to 61.07% for closed). This result is portrayed in Figure 5.2.J. Post-hoc Scheffé tests indicated that while the illiterates performed significantly worse on closed syllables than did the literates, the two groups did not differ signficantly from chance on open syllables.

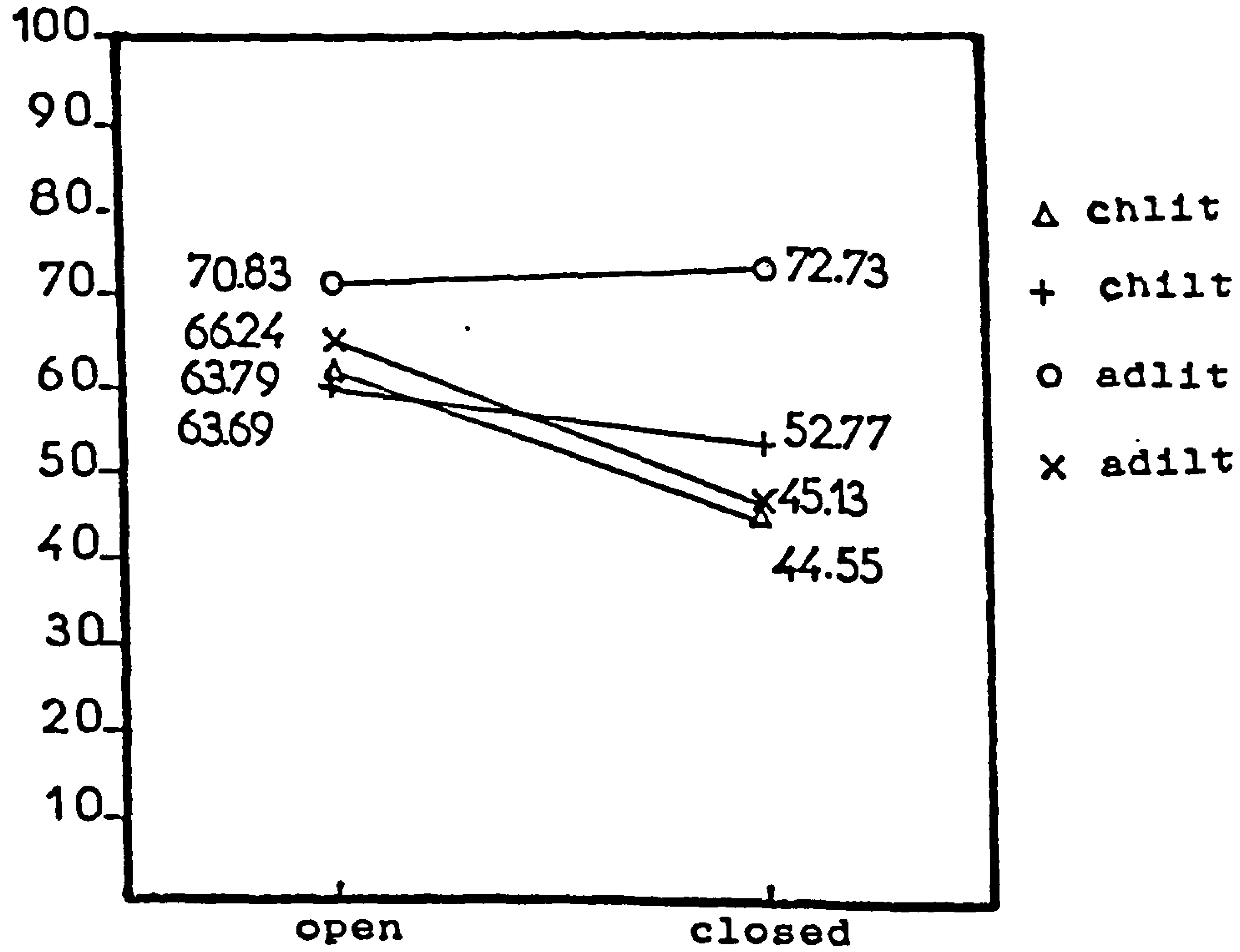
These results were, however, qualified by a further three way Age x Literacy x Syllable Type interaction (F_1 (1,112) = 8.04,p <.005; F_2 (1,32) = 9.91,p <.003). Essentially, this interaction appears to reflect the fact that illiterate Ss not only found the relative difficulty of closed syllables greater than did the literates, but were more affected when they were adults. Conversely, in the literate group, children were more affected than adults (see Figure 5.2.K). Post-hoc tests disclosed that pairwise comparisons were reliable when they included the results for closed syllables of either literate children or illiterate adults. These two data points, which did not differ from each other, were significantly lower than all others. Thus, whether the initial syllable was open or closed determined the performance of illiterate adults and literate children, but was less important for literate adults and illiterate children.



Experiment 2 - Fig. 5.2.I: Mean percentage correct responses as a function of syllable type



Experiment 2 - Fig. 5.2.J: Mean percentage correct responses as a function of literacy and syllable type



Experiment 2 - Fig. 5.2.K: Mean percentage correct responses as a function of age, literacy, and syllable type

2.4 Effect of Stress

Although it features in the experimental design, the stress variable was not submitted to an analysis of variance. There are two reasons for this. First, the original analysis involving the length variable revealed that there was a tendency to perform worse on monosyllables (these are, of course, stressed) than on bisyllables (these are half initial stressed) and trisyllables (these are never initial stressed) which did not differ. Second, the second analysis in which monosyllables were excluded, indicated that there was no significant difference in overall performance and no interaction of either age or literacy with length.

From these results, it is clear that the stress factor did not have an effect on the Ss' ability to perform the task [12]. If performance on either monosyllables and bisyllables had been better than on trisyllables, then we would have suspected a stress effect or an interaction between stress and length. As it happens, there was not any. Given this, it seems that stress does not influence performance by highlighting certain syllables at the expense of others. That is, stress does not seem to be used as a cue to initial syllable identification. It is not an appropriate specification of 'salience'. Put differently, this finding indicates that the process underlying the phonemenon of initial syllable indentification must be regarded as an active one, ie not passively dependent on the 'surface' prosody.

At least one finding from a different experimental paradigm seems to support this result. Thus, Cole and Jakimik (1980) examined whether the lexicon is accessed via stressed syllables. Employing a listening for mispronunciation task, they contrasted syllable stress (ie stressed v unstressed) and location within word (ie first position v second position). Their findings revealed that, though mispronunciations were more often detected in stressed than unstressed syllables, they were detected more rapidly when they occurred in the <u>first</u> than in the second syllable. Again, this is an indication that stress is overruled by position.

To summarize, of the three linguistic variables, namely length of stimuli, stress and syllable structure, which were hypothesised to affect performance, only the latter yielded reliable effect. Open syllables were more successfully identified than closed syllables. This effect, however, was more marked in the illiterates than the literates.

In light of the findings yielded by the analysis of the linguistic variables, some of our earlier interpretations ought to be reconsidered. In particular, our conclusion that age is an important factor only when it also correlates with markedly increased literacy does not seem to be warranted. Instead, considering the data in their entirety, these suggest that age and literacy have little bearing on the ability of <u>S</u>s to attend to the initial syllable as tapped by the present experiment. There are four sources of support for this interpretation. First, it is clear that the child and illiterate <u>S</u>s performed less well than the adult and the literate <u>S</u>s, respectively, only because the literate adults' performance increased the grand mean for the latter age groups.

Second, it is equally clear that the children were difficient in relation to adults only in their consideration of the monosyllabic stimuli. Third, this effect, it was argued, was most probably due to an artifact which caused younger Ss to adopt a strategy that favoured segmentation when none was necessary.

Finally, when those 'weak' items were omitted and the data reanalysed, there were no longer any age, literacy or length effects; nor were there any interactions.

Regardless of the plausibility and explanations of the artifactual effect, further outcomes are available which point to similar performances across age and literacy. Summarized there are:

(i) Evidence from correlational analyses indicate that age and level of literacy as measured by school (or no school) grade, had no influence on performance among the child Ss. Even the youngest children in the study were sensitive to the task.

(ii) Similarity of performance between illiterate adults and literate children is striking.

(iii) Equally striking is the similarity between the literate and illiterate children, with the latter even performing slightly better.

(iv) Other than the obtained Age x Length interaction, no relevant strong interaction between subject and stimuli variables was obtained.

While these findings seem to be compatible with the claim that the initial syllable is a naturally available unit - a point we discuss below - they are not, however, consistant with the view that metalinguistic abilities are affected by maturational change. Thus, even the youngest Ss in the study were sensitive to the task.

We have noted above that the findings provide evidence for the availability of the initial syllable for conscious manipulation and, by the same token they also tend to reinforce the conclusions drawn in the studies cited earlier in support of the role of the syllable in various speech behaviours. However, it would not be accurate to claim that the syllable structure was thoroughly transparent to Ss. In particular, while there was no tendency to perform successfully when the initial syllable was part of a short rather than a long word, or when it carried the main stress, there was, on the other hand, a preference (in the statistical sense) for open syllables. More specifically, a preference for a simple equal-length consonant-vowel pattern.

While we think that difficulty with non-open syllables reflects the need for segmentation at the syllable boundary, it can also be interpreted as due to the salience of open syllables. Support for this interpretation can be sought in the fact that CV syllable shape is the least marked (Kiparsky, 1979). Research on language universals indicates that all languages possess a CV syllable type. Of all languages studied, no one has been found to have CVC pattern which was not found to have a CV pattern, but the opposite is not true. It may turn out to be a phonological universal. Diachronically, languages have always displayed a tendency toward open syllabicity (Kiparsky, 1979). In phonological processing, strengthening of a consonant occurs mainly in initial position, hence the importance and priority of syllable initial position and the corresponding preferred CV syllable structure.

In contrast, assimilation which is a weakening proceess, occurs in syllable-final position. Final consonant-drop is common. Although no frequency count is available, there is some evidence (Al Ani, 1978), that of all the possible syllable shapes in Standard Arabic, CV shape is the most frequent and distributionally, operates without constraints in the language.

Developmental phonology also provides some evidence. Infants, it appears, babble in CV syllables with other types developing later. Omission of final segments is a very common procedure in children's speech: ball -> be; boot -> bu (eg Clark and Clark, 1977). Apparently, most cases of hesitations, false starts and stuttering occur in terms of open syllables (Linell, 1979). Concerning individual languages, in French, for example, there is a tendency in masculine nouns, abbreviations and diminutives to have a terminal CV configuration (Casagrande, 1983). The case of abbreviations in particular is interesting. Thus, although 'aper', 'mecan' and 'pharmaque' are possible abbreviations for 'aperitif', 'mecanicien' and 'pharmacien', respectively, they are not used. Instead, we have 'apero', 'mecano', and 'pharmaco'.

Before we conclude, we examine a second and important trend which emerged in the data.

It will be recalled that the data indicated that while age and literacy groups demonstrated that they possessed greater capacity for identifying the initial syllable, it also showed there was a tendency in the literate children to perform less well than the other groups. Though not statistically significant, this latter finding seems sufficiently interesting to be discussed. At the risk of a paradox, it can be interpretable as indicating not only that literacy is not a facilitative factor in a metalinguistic task like the one at hand, but can also exert a negative effect on the awareness of the initial syllable in the beginning reader. That is, it is likely that familiarisation with literacy causes the beginning reader's intuitive notions of the syllable to be in competition with the written form of the language. In particular, it may encourage focus on the segment or precisely the 'letter' which ensues from interference with the written language and thus, may lead to some metalinguistic confusion. This may be particularly acute in 'diglossic' children like the Ss of the present experiment (see Chapter 2). This is because a child who is given his first introduction in reading in a different 'dialect' from the one that he speaks becomes exceedingly confused about the relationship between speech and writing. It is not inconceivable that diglossic children learn how to pronounce certain words after they have 'seen' them in writing.

That this might be the case, is supported by a qualititave analysis of the data which suggests the existence of some persistent contamination by reading. The data indicate that literate children's responses to some stimuli were influenced by whether they were similar to Modern Standard Arabic - the language of formal school education. For example, responses to /ħma.ma/ and /bəg.ra/ were /ħa./ and /ba/ instead of / ma./ and /bəg/. In Standard written Arabic, these words are rendered, respectively, as / ama:mah/ and /baqarah/ [13]. Confirmation of this is provided by the last line of the knock-knock procedure which requires Ss to repeat the whole stimulus after giving the initial syllable. When they do not adopt this strategy, the literate children sometimes give the initial letter value of the initial segment which also happens to have a syllabic letter name. For example, <ba> is the letter value for the segment /b/.

A related alternative interpretation would be that since the children had available different phonological representations for a given stimulus, they had available two sources of information to consult, either the spoken language (Moroccan Arabic) or the written formal language of education (Modern Standard Arabic). Of the two competing representations, and depending on the stimulus, Ss' preference here was for the one which allows fewer clusters (eg Modern Standard Arabic ħa.ma:ma (h) and ba.qara (h) v Moroccan Arabic ħma.ma and bəg.ra). This strategy may, perhaps, account for the rather wide variability in the children's performance.

In a study comparing groups of adults of high and low level of literacy, Barton and Hamilton (1982) made a very similar observation. They found that the two groups differed the most in their answers to various analytic questions about language because the high level literate adults segmented multisyllabic words as they were spelled, whereas low borderline literates did not.

The notion that a child's phonological knowledge may become quite complex as he is introduced to the rudiments of reading and writing, particularly if he is 'diglossic', will be further examined when the general issue of the impact of literacy is discussed in subsequent chapters.

IV Experiment 3

The data we have examined in Experiment 2 pertain only to one aspect of syllable awareness, namely, the ability to attend to and consciously manipulate a syllable in word-initial position. This ability was displayed equally by all groups of Ss regardless of age or literacy. To what extent, might Ss exhibit similar abilities in attending to a syllable beyond the word initial position? This is the main question Experiment 3 seeks to investigate.

The answer is not immediately obvious, particularly in view of the fact that little empirical research is available which deals with non-initial position. Typically, much psycholinguistic research involving such units of speech as syllables and segments tends to concentrate primarily on examples in word-initial position.

As Jusczyk (1981) observed with reference to infants' speech perception, investigating the possibility of a 'position effect' on the awareness of a unit would contribute toward better understanding of the 'availability' of the unit for conscious manipulation and in general of the process of metalinguistic abilities.

Accordingly, the present experiment was specifically designed and carried out to assess the metalinguistic knowledge of the syllable in word-final position. Medial syllables were not examined for several reasons. First, stimuli allowing tests of syllable identification in medial positions would invite artefacts from excessive stimulus length, since, no words shorter than trisyllables could be employed. Second, since in Moroccan Arabic trisyllabic words are typically stressed on their penultimate syllables, syllable position would be counfounded with stress. Findings based on the medial syllable then would not be strictly comparable to those in Experiment 2 (ie initial syllable), nor particularly interpretable in isolation.

A. The Final Syllable

Unlike the medial syllable which may be vulnerable to interference from its surrounding context, but like the initial syllable, the final syllable is adjacent to silence and might have particular phonological salience. Indeed, some evidence, albeit not always conclusive, exists which is interpretable as supporting the salience of the syllable in final position. In what follows, we examine some of this evidence which comes from various behaviour sources.

To provide explanations for possible Universals in the ontogenesis of grammar, Slobin (1973) provided a formulation of strategies the language-learning child might employ when scanning linguistic input for cues to meanings. One such strategy (Slobin's Operating Principle A) is relevant here. This principle states: pay attention to the end of words. It was derived from evidence that, first, the existence of final syllable lengthening in many languages serves as the cue that the linguistic unit in speech has terminated; second, that children often imitate only the last part of a word. As evidence, Slobin cited examples from English, Hebrew and Arabic child phonology. Although, these hypothesised operating principles were meant to be explanations for suggested universals in the onto-genesis of grammar, it does not seem implausible that these or similar principles might remain as general heuristics, even for older children or adults when they are required - as in the present experiment - to attend to the 'end of word' by identifying and manipulating its final syllable. It is important, however, to note that in the examples cited by Slobin (p 189) English ("raff" for giraffe), Hebrew ("sayim" for mixnasayim) and Arabic ("hibb' for am-yhibb), the retained syllables appear to receive the major stress as well as the last position. To defend the significance of last position against the confounding of the stress factor, Slobin does offer some data from Czech, illustrating incidence of omission of initial stressed syllables. But as yet there is little experimental evidence confirming Slobin's claim for the last syllable salience.

Along the same lines, Peters (1983) noted the ability of children to 'extract the units of speech' during the course of acquiring language and hypothesised that this ability to remember utterance-initial and utterance-final syllables "may be enhanced by the tendency for items at the end and beginning of a series (especially at the end) to be remembered better than items located in the middle" (p 36). Besides referring the reader to Kintsch (1977) for a review research on serial recall by adults, and to Hagen and Stanovich (1977) for work with children, Peters also cites Pye (1980) who makes a good case for the salience of word-final syllables in language acquisition, particularly when they are stressed. Pye's evidence is based on children acquiring

Quiche Mayan, an Indian language. Peters (1983) proposes that a strategy of paying attention to final syllables should make a language with word-initial stress harder to learn because such a situation, she claims, would "produce a conflict between two saliencey factors: Stress and recency" (p 36). She further suggests that stress and initial position (location) together would carry more weight than final position (recency) by itself.

Another source of evidence comes from experimental work in the area of infant speech perception. Although there are available only very few studies on how infants cope with speech information that occurs in non-initial position of utterances, these have raised some interesting questions about the stimulus features and organisation that facilitate perception of embedded or utterance final syllables. Two studies will be discussed here. Jusczyk and Thomson (1978) examined the ability of two-month-old infants to discriminate place of articulation (/ba/ v /ga/) within bisyllabic strings. They observed that infants could discriminate these contrasts in both the initial (/bada/ v /gada/) and final (/daba/ v /daga/) syllable positions. In a study of voicing discrimination, Trehub (1973) also found evidence that infants 4 to 17 weeks of age could discriminate /ba/ v /pa/ when presented in bisyllabic sequence. However, they failed to discriminate the same sounds when presented in the trisyllabic sequence /ataba/ v /atapa/. Of particular concern here is the finding that performance varied with the length of the stimuli. We also predict that length will be an important feature in our metalinguistic task in that performance will be better on bisyllabic than trisyllabic stimuli.

Also relevant here is evidence from studies of rhyming in children. Numerous examples of child-created rhymes have been reported, based on observation of children as young as two and three years of age (Weir, 1962; Chukovsky, 1963; Slobin, 1978; McGee, 1980). Some empirical studies (eg Knafle, 1973, 1974; Jusczyk, 1977; see also Bryant and Bradley, 1983, 1985) are available which tapped children's "appreciation" of rhyme. Jusczyk's study, for example, showed that first and third grade American children with mean age of 6;4 and 8;5 years respectively, were far less able to deal with alliteration than with rhyme. Jusczyk interpreted this to mean that alliteration may be more difficult to perceive than rhyme for reasons having to do with the location of each 'device' within a line. Typically, alliteration involves words which occur in the middle of a line, whereas rhyme is usually at the end of lines. Perhaps the position of rhymes may make them less subject to interference by the adjacent context, and thus more likely to attract the listener's attention. In sum, since rhyming requires detecting which final sounds are the same and which are not, and since it seems to be characteristic of children as young as two and three years of age, one might suppose that the final syllable is readily available.

Data of other types such as 'the tip-of-the-tongue' phenomenon (TOT) also reveal the salience of the final syllable. This evidence is provided, for example, by the various guesses which speakers make in their attempts to remember a word. A speaker searching for the name Ghirardelli, for example, produced the following guesses Garibaldi, Gabrielli, and Granatelli (Browman, 1978). Besides having the same number of syllables with the target word, these "guesses" also have initial and final syllables in common. In this context, Brown and McNeill (1966) proposed that the lexical entries of less frequently used words could become faint with disuse, so that only the beginning and the end could be clearly remembered or read. Again, this presupposes that initial and final position syllables are prominent.

In sum, there is evidence, at least from the studies examined above, which suggests that the final position in general, and the final syllable in particular, can be a prominent feature in various linguistic behaviours. Accordingly, we would expect that it would be as readily available for conscious manipulation as the initial syllable.

However, whereas identification of the initial syllable need not involve an extensive analysis of the word structure given its position, the final syllable might prove more difficult to identify because just such an analysis might be required. If this assumption is correct, we would expect final syllable identification to be sensitive to length (in syllables) of the stimulus word and to the structure of the syllables contained in the stimulus. Specifically, it would be expected that performance in this experiment would vary with whether the target syllable was preceded by an open or closed syllable and whether the stimulus was a bi- or tri-syllabic word. From Experiment 2 we already know that closed syllables elicited significantly more errors than did open syllables.

B. Method

1. Materials And Design

The 36 words used as stimuli in the present experiment were those in Experiment 2, (see Appendix B) but now Ss in Group A were assigned stimuli from Set B and those in Group B were assigned stimuli from Set A of previous experiment (Latin Square Design). The stimuli were presented in the same ordering as in Experiment 2.

As Table 5.3.1 below illustrates, the number of open syllables in final position is higher than the number of closed syllables. This reflects the phonology of the language in which open syllables happen to occur mostly in word final position (see Benhallam, 1980). The table also shows the type of syllables preceding the target syllables (ie whether open or closed).

	Stimuli	Type of Final Syllable		Type of Preceding Syllable	
	Length	Open	Closed	Open	Closed
Monosyllabic	6	3	3	-	-
Bisyllabic	6	3	3	3	3
Trisyllabic	6	6	-	4	2
	18	12	6	7	5

EXPERIMENT 3 - Table 5.3.1: The distribution of stimuli in each set as a function of length of stimuli, type of final syllable (open v closed) and type of syllable preceding target (open v closed).

2. Procedure

The procedure employed here was identical to the one in Experiment 2 with the exception that Ss were required to give the final instead of the intitial syllable in the knock-knock game.

C. Results and Discussion

1. Subject Variables

1.1 Scoring and Data

The scoring principle was similar to Experiment 2. A response was correct when the final syllable was recognised. The data, as illustrated in Table 5.3.2 are based on scores for bi- and tri-syllabic stimuli only. It will be recalled that this experiment employed the same stimuli as in Experiment 2. A preliminary analysis was performed which indicated that the difficulties caused by the monosyllabic items in the previous experiment surfaced here as well (compare Table 5.3.2 and Table 5.3.3). Subsequently, scores obtained for monosyllabic stimuli were excluded.

		LITERACY	
		Literate	Illiterate
AGE	CHILD	51.47	7.02
	ADULT	64.81	21.52

EXPERIMENT 3 - Table 5.3.2: Mean percentage correct responses (including monosyllables) as a function of age and literacy.

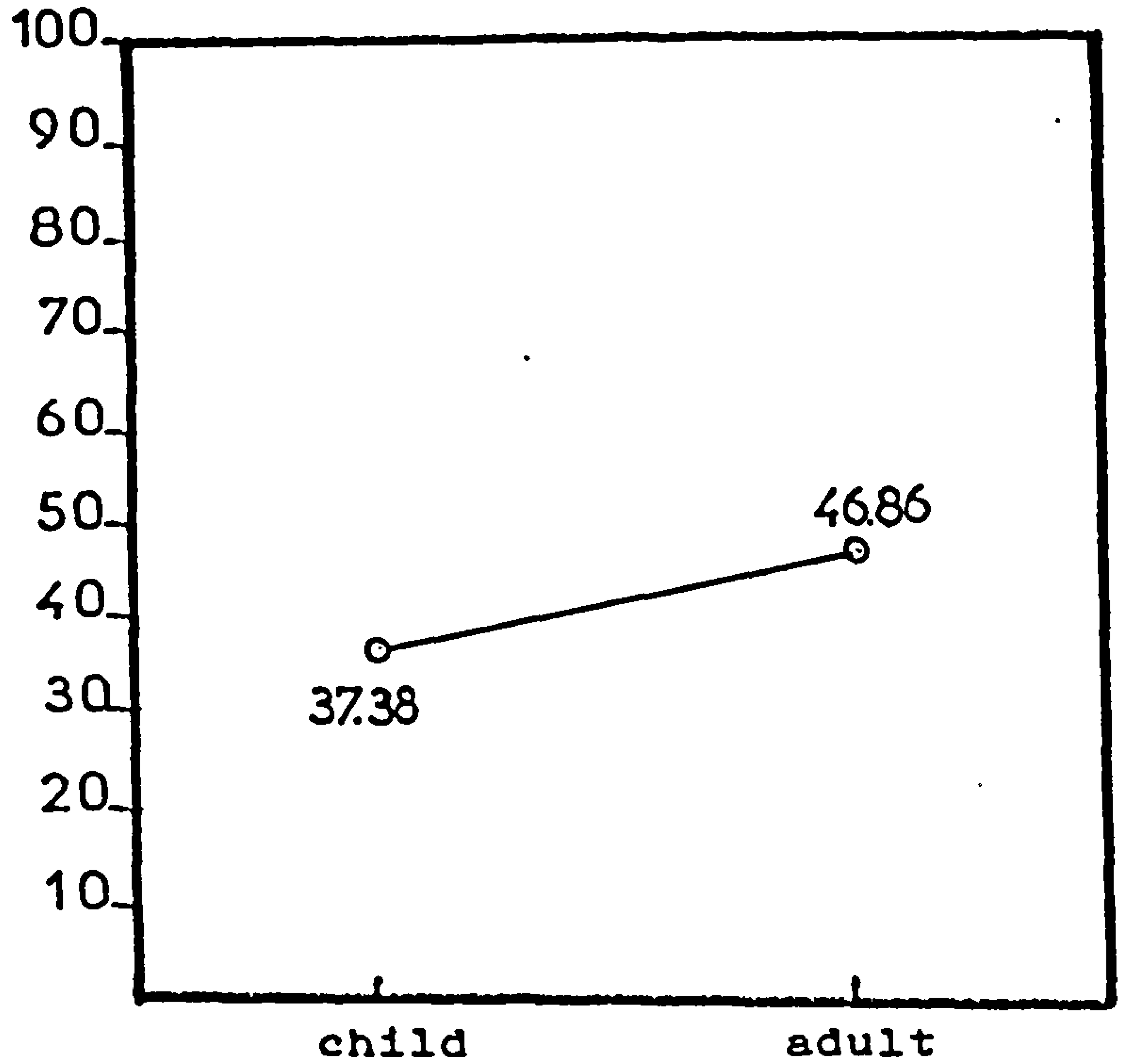
		LITERACY			
		Literate		Illiterate	
AGE	CHILD	62.06	(20.89)	12.70	(25.09)
	ADULT	68.39	(17.83)	25.34	(27.89)

EXPERIMENT 3 - Table 5.3.3: Mean percentage responses without monosyllables as a function of Age and Literacy. Station deviations are in parentheses.

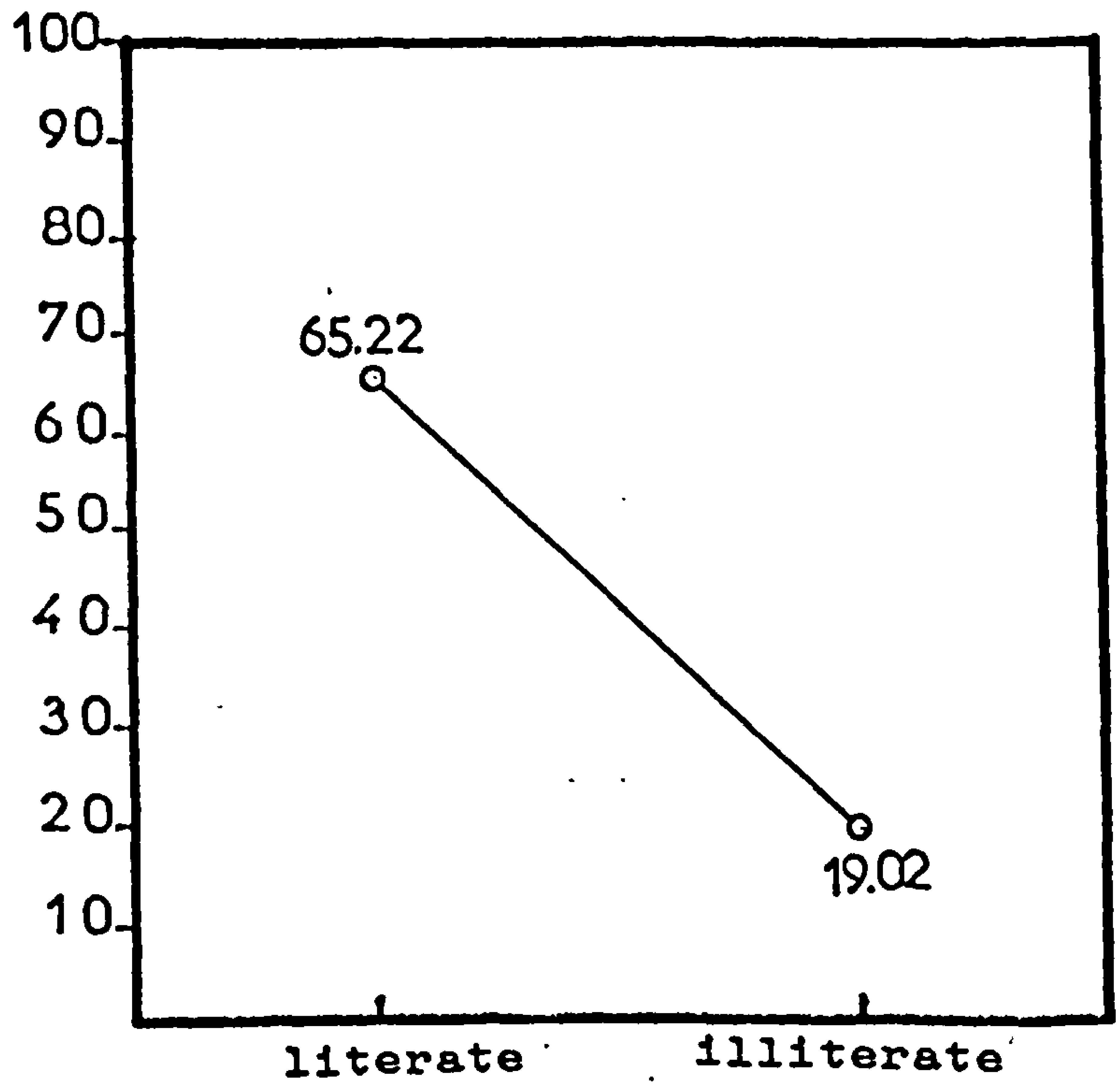
The pattern of results observed here was quite different from that in Experiment 2. The direction of the effects was not the same at every age and literacy level. Thus, while the listeners' performance here was similar to the previous experiment ($\bar{X}$ = 65.61% in Experiment 2 v 65.22% here), there was a dramatic fall off in scores obtained by illiterate Ss ($\bar{X}$ = 60.40% in Experiment 2 as compared to 19.02% in Experiment 3). These data also show that while overall performance by adult Ss was bettern than child Ss, the fall off in scores for the children (25.76%) was not as substantial as it was for the illiterates.

1.2 Analysis And Findings

1.2.1 ANOVAs. The data were analysed as in the previous experiment. The effect of age (Figure 5.3.A), though siginicant by Ss (F_1 (1,110) = 4.61,p <.03) [14] and by materials (F_2 (1,22) = 12.66,p <.0018), did not achieve statisitical significance on the combined analysis (min F'



Experiment 3 - Fig. 5.3.A: Mean percentage correct responses as a function of age



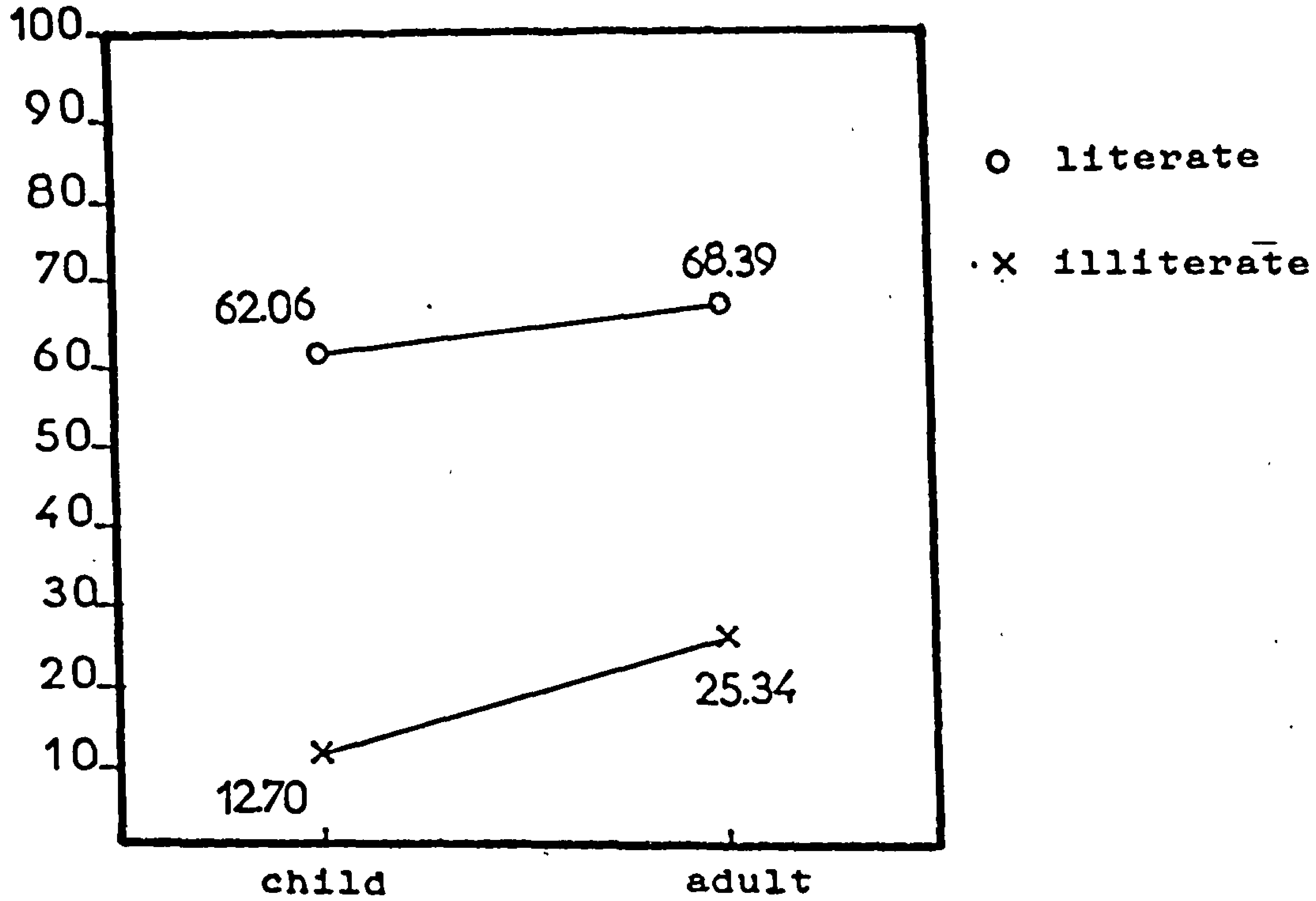
Experiment 3 - Fig. 5.3.B: Mean percentage correct responses as a function of literacy

(1,75) = 3.37, n.s). This result was mainly due to the moderate reliability by Ss. Means for the child and adult Ss were $\bar{X}$ = 37.37% and $\bar{X}$ = 46.86%, respectively.

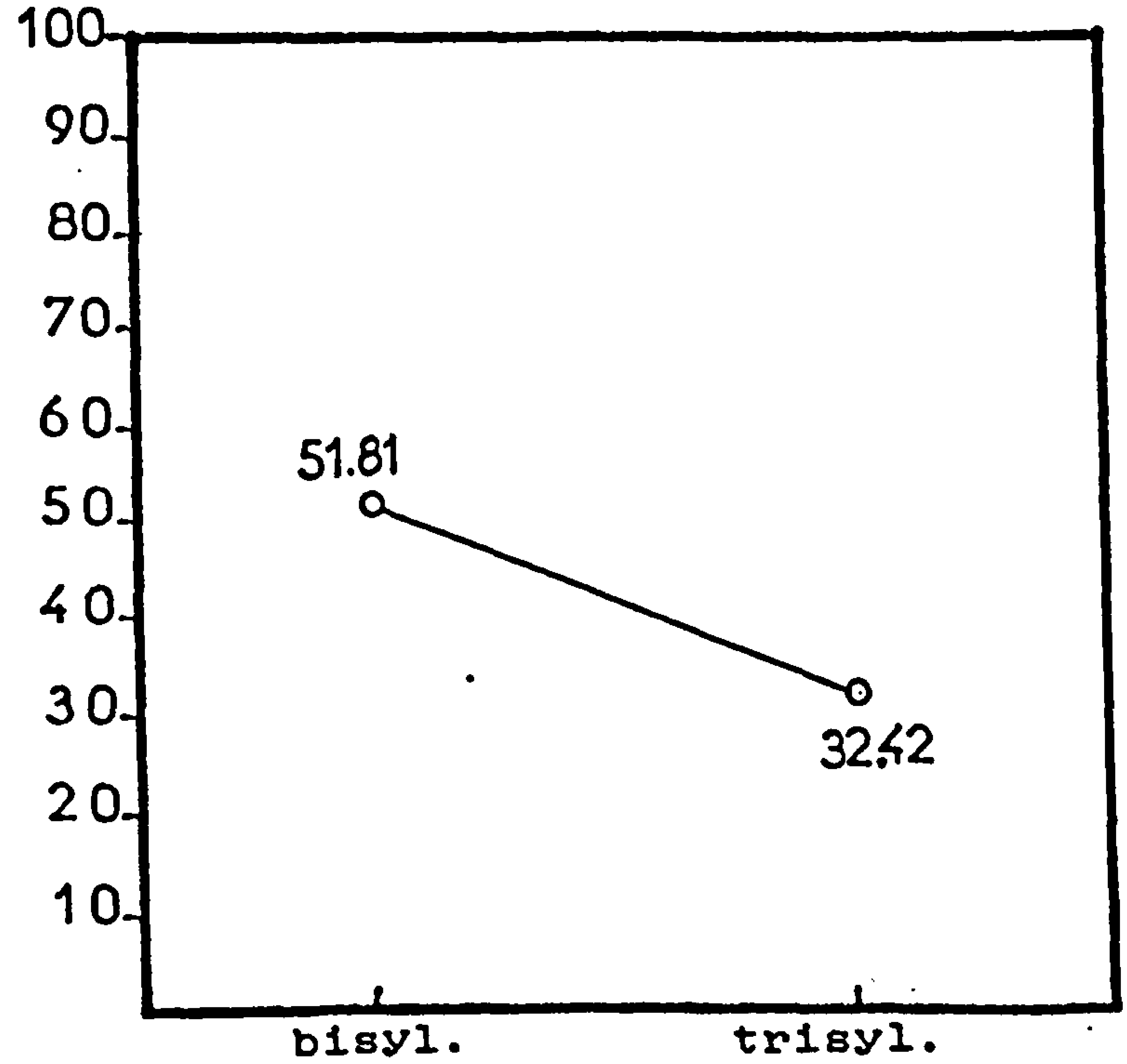
The effect of Literacy, however, was greater and thus accounts for most of the variance in both by Ss and by materials analyses (F_1 (1,110) = (109.67,p <.0001; F_2 (1,122) = 186.59,p <.0001; min F' (1,101) = 60.07,p <.01). Means for the literate Ss were 65.22% as compared to 19.02% for the illiterate Ss. Figure 5.3.B plots these results.

The interaction between the effects of Age and Literacy was not reliable (F_1 (1,110) = 0.38,p >.05; F_2 (1,22) = 1.04,p >0.31). In view of the very robust main effect of literacy and the relatively weak effect of age, this result should be expected. Again, although not significant, this result is displayed in Figure 5.3.C for purposes of comparison with Experiment 2.

1.2.2 Correlations. The overall results were supplemented with correlation tests for the child data. There does appear to be a high degree of correlation between the children's school grade (or no grade in the case of illiterates) and task score (r = 0.69) t(1,68) = 7.04,p <.001 as well as a moderate but significatn relationship between age and task (r = 0.47); t(1,68) = 4.40,p <.01. When, however, grade was controlled for in the correlation (ie Age x Task . Grade), the relationship between Age and Score dropped to a negligible level (r Age x Task . Grade = 0.04). In contrast, the relationship between grade and



Experiment 3 - Fig. 5.3.C: Mean percentage correct responses as a function of age and literacy



Experiment 3 - Fig. 5.3.D: Mean percentage correct responses as a function of length and stimuli performance continued to be considerable even when age was partialled out (r Grade x Score . Age = 0.51). These results clearly demonstrate that of the two variables, age and grade, the latter is more important. Performance of the children seems to be predictable not by how old they are but by whether they are literate or not. These results bear out the results of the ANOVA already reported which indicated that much variance in all Ss performance is accounted for by the literacy factor rather than by the age factor.

The above tests concern all the child Ss. To examine a change in performance from first to second grade, literate children only were considered. On this occasion, no relationship was to be found to exist between either grade and score ($r = 0$) or age and score ($r = 0.07$). Interestingly, means were virtually identical ($\bar{X}$ = 62.05% and 62.49% for grade 1 and grade 2, respectively). The absence of any difference between the two school grades is particularly impressive when one recalls that grade 1 children had had only about eight months of schooling. This is an important finding which will be discussed in the General Discussion section.

Overall, these correlation tests provide further evidence for the finding that the observed variance was most likely related to general advances in literacy rather than advances in maturation.

2. Linguistic Variables

As stated above, two linguistic factors were expected to affect performance, namely the length of the stimuli and the type of syllable preceding the target. The procedure and method for the statistical analysis followed those in Experiment 2.

2.1 Effect of Length

As can be seen in Table 5.3.4, performance varied with length of stimuli, with the final syllable being more successfully recognised in bisyllabic than trisyllabic stimuli. Means were 51.81% for bisyllabic as compared to 32.42% for trisyllabic stimuli. This difference was found to be highly reliable both by Ss (F_1 (1,110) = 39.10,p <.0001) and by materials (F_2 (1,20) = 41.79,p <.0001), thus yielding a highly significant min F' (1,71) = 20.18,p <.01. These results are summarized in Figure 5.3.D.

	LENGTH			
	Bisyllable		Trisyllable	
CHLIT	75.86	(20.00)	48.26	(36.06)
CHILT	16.15	(32.21)	9.25	(23.57)
ADLIT	84.71	(16.29)	52.07	(30.31)
ADILT	30.54	(35.03)	20.13	(29.18)

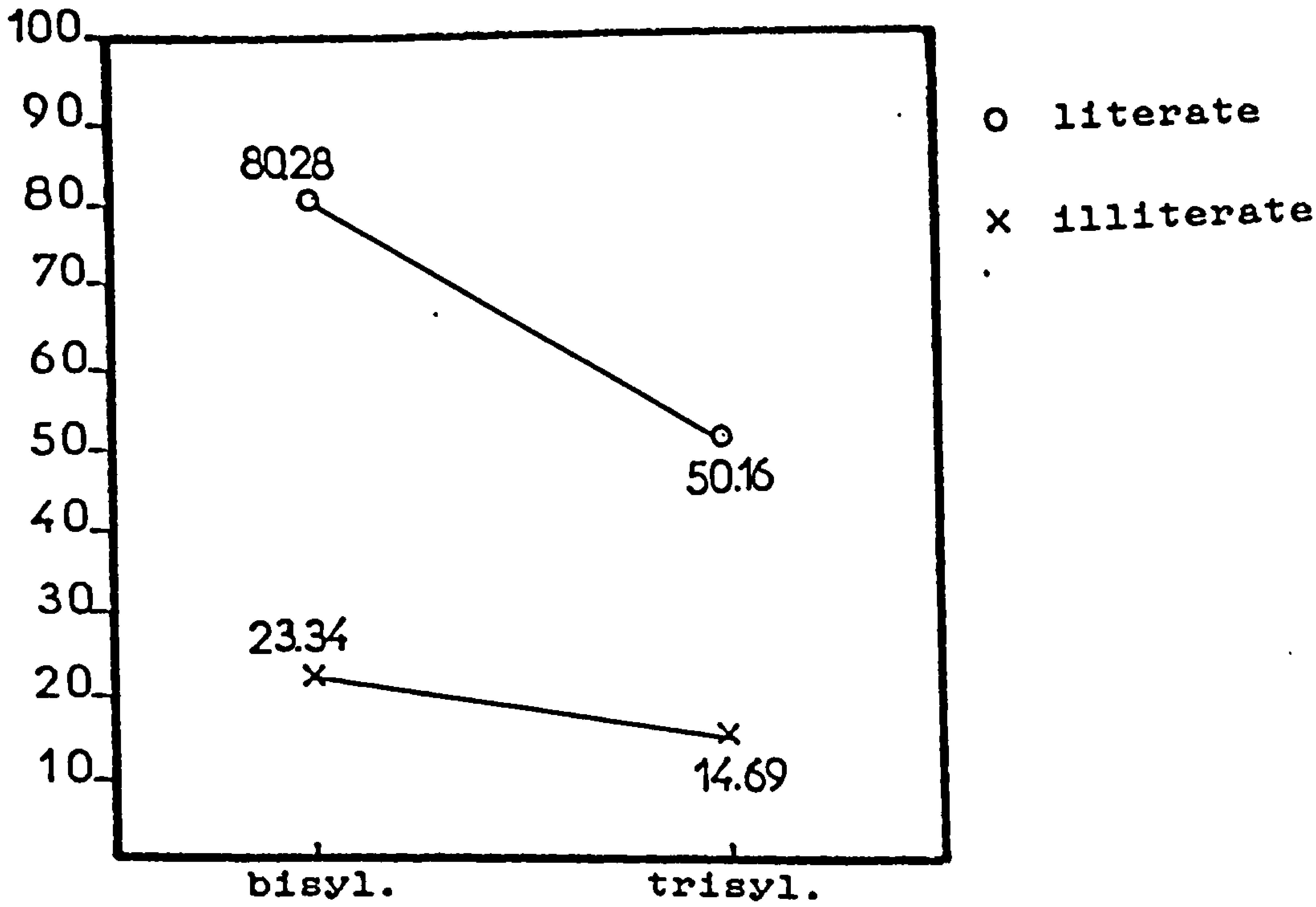
EXPERIMENT 3 - Table 5.3.4: Mean percentage correct responses as a function of Age, Literacy and Length of stimuli (bisyllabic v trisyllabic stimuli). Standard deviations are in parentheses.

The effect of literacy was also highly significant. (F_1 (1,110) = 110.97, $p < .0001$; F_2 (1,20) = 381.60, $p < .0001$; min F' (1,125) = 85.96, $p < .01$). The effect of age, on the other hand, was once again only moderately significant by both Ss and materials with min F' failing to achieve significance.

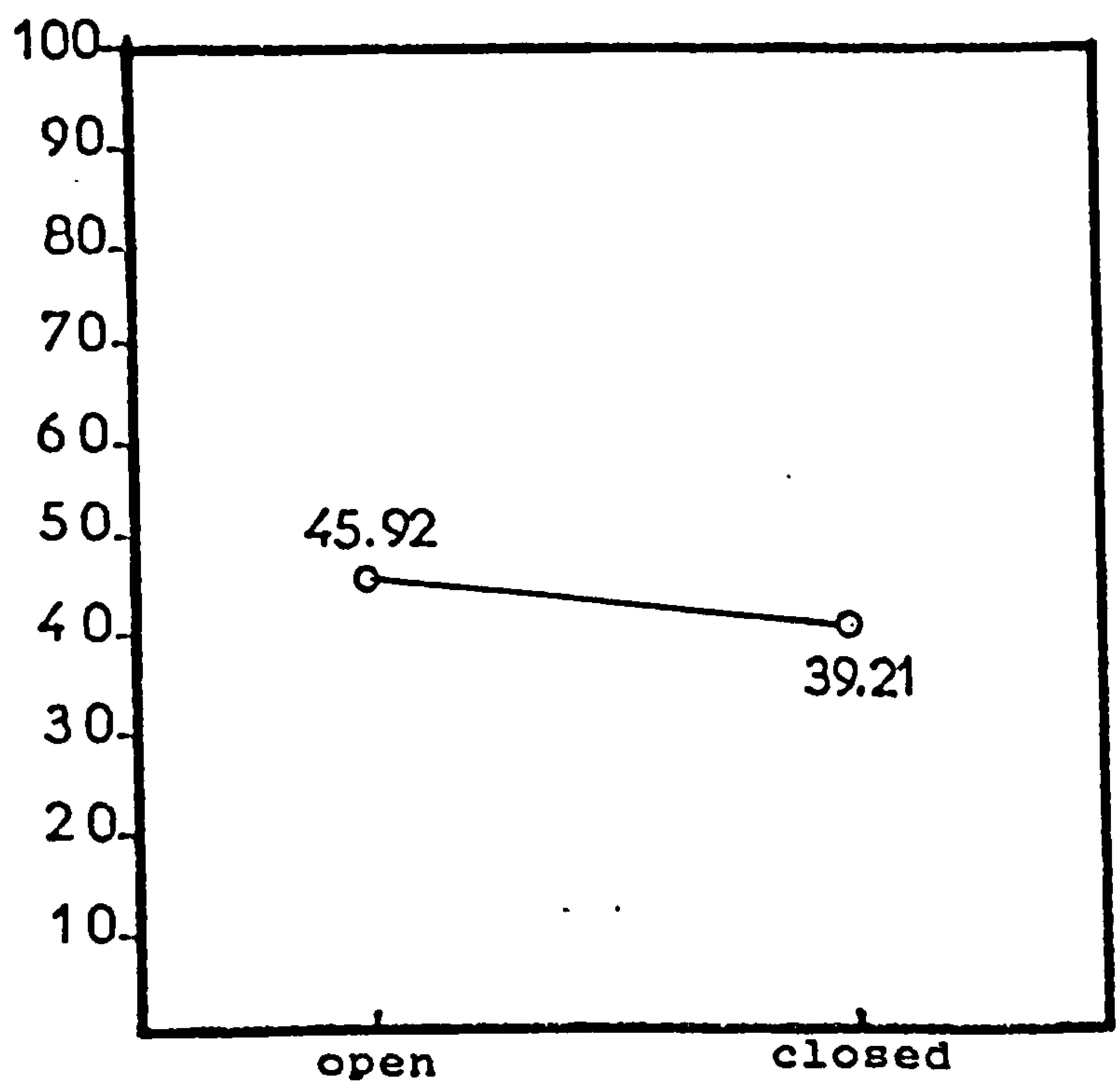
Results of the ANOVA also indicated that while overall performance varied with length of stimuli, both age groups were sensitive to this factor. This is shown by the absence of an age x length interaction (F_1 (1,110) = 0.65, $p > 0.43$; F_2 (1,20) = 0.19, $p > 0.66$). Means for children and adults were 46.0% v 57.62% for bisyllabic stimuli and 28.75% v 36.1% for trisyllabic. However, the interaction between literacy and length was very reliable (F_1 (1,110) = 9.85, $p < .0002$; F_2 (1,20) = 20.58, $p < .0002$; min F' (1,106) = 6.66, $p < .05$). Although the literates outperformed the illiterates overall, the difference between them was greater for bisyllabic (80.28% correct for literates v 23.34% for illiterates) than trisyllabic (50.16% v 14.69%) words. Furthermore, the effect of length was more pronounced for the literates than for the illiterates. This may be attributable to a floor effect among the illiterates whose scores on either type effect did not differ (Scheffé, $p > .05$). These results are graphically presented in Figure 5.3.E.

2.2 Effect of the Preceding Syllable

Since Experiment 2 showed that closed syllables produced more



Experiment 3 - Fig. 5.3.E: Mean percentage correct responses as a function of literacy and length of stimuli



Experiment 3 - Fig. 5.3.F: Mean per centage correct responses as a function of the type of syllable preceding the target syllable errors than open syllables, it was expected that performance in this experiment would vary according to the syllable preceding the target syllable was preceded by an open or closed syllable. To this end, a factor analysis of variance 2(Age) x 2(Literacy) x 2(Preceding syllable (open, closed)) was performed twice, collapsing over Ss and then over items.

Again, in the previous analyses, results of this ANOVA revealed a very highly significant main effect of literacy (F_1 (1,110) = 95.74,p <.0001); (F_2 (1.20) = 151.69,p <.0001) and a moderately reliable effect of age (F_1 (1,110) 5.01,p <.02; F_2 (1,20) = 16.98,p <.0005). No interaction between the two effects was recorded. While these effects will not be discussed further as simple effects, their interaction with the main effect of the syllable preceding the target will be considered.

From the overall means presented in Table 5.3.5, it may be seen that there was a tendency for final syllables to be more successfully recognised when they were preceded by closed syllables ($\bar{X}$ = 45.92%) than by open syllables ($\bar{X}$ = 39.21%). This difference was found to be significant by Ss only (F_1 (1,110) = 5.54,p <.02; F_2 (1,20) = 1.93), (see Figure 5.3.F).

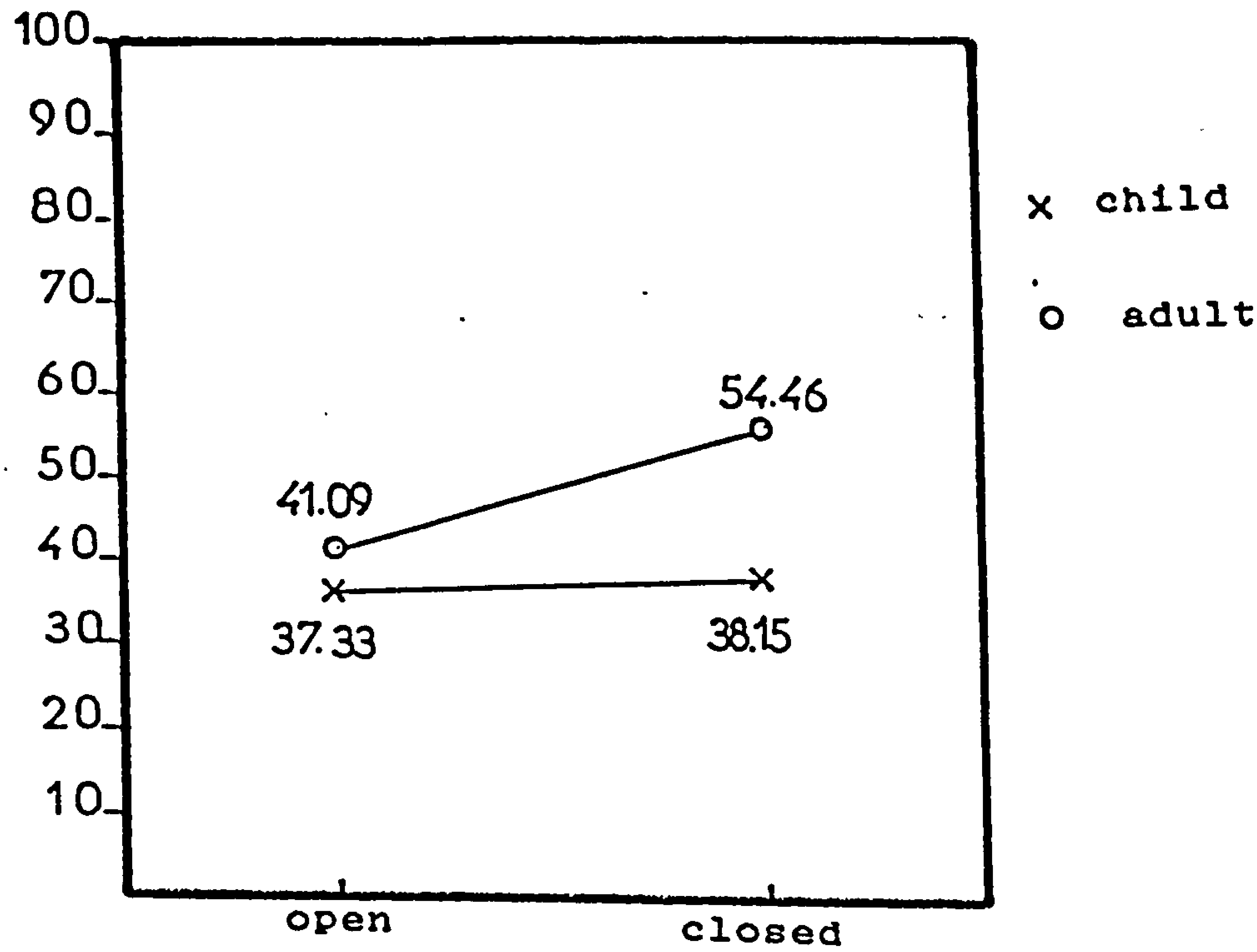
	PRECEDING SYLLABLE			
	Open		Closed	
CHLIT	61.01	(29.81)	62.66	(28.50)
CHILT	13.65	(26.03)	12.10	(27.45)
ADLIT	61.09	(26.21)	78.52	(22.56)
ADILT	21.10	(29.76)	30.40	(35.22)

EXPERIMENT 3 - Table 5.3.5: Mean percentage correct responses as a function of Age, Literacy and Type of syllable preceding target (open v closed). Standard deviations are in parentheses.

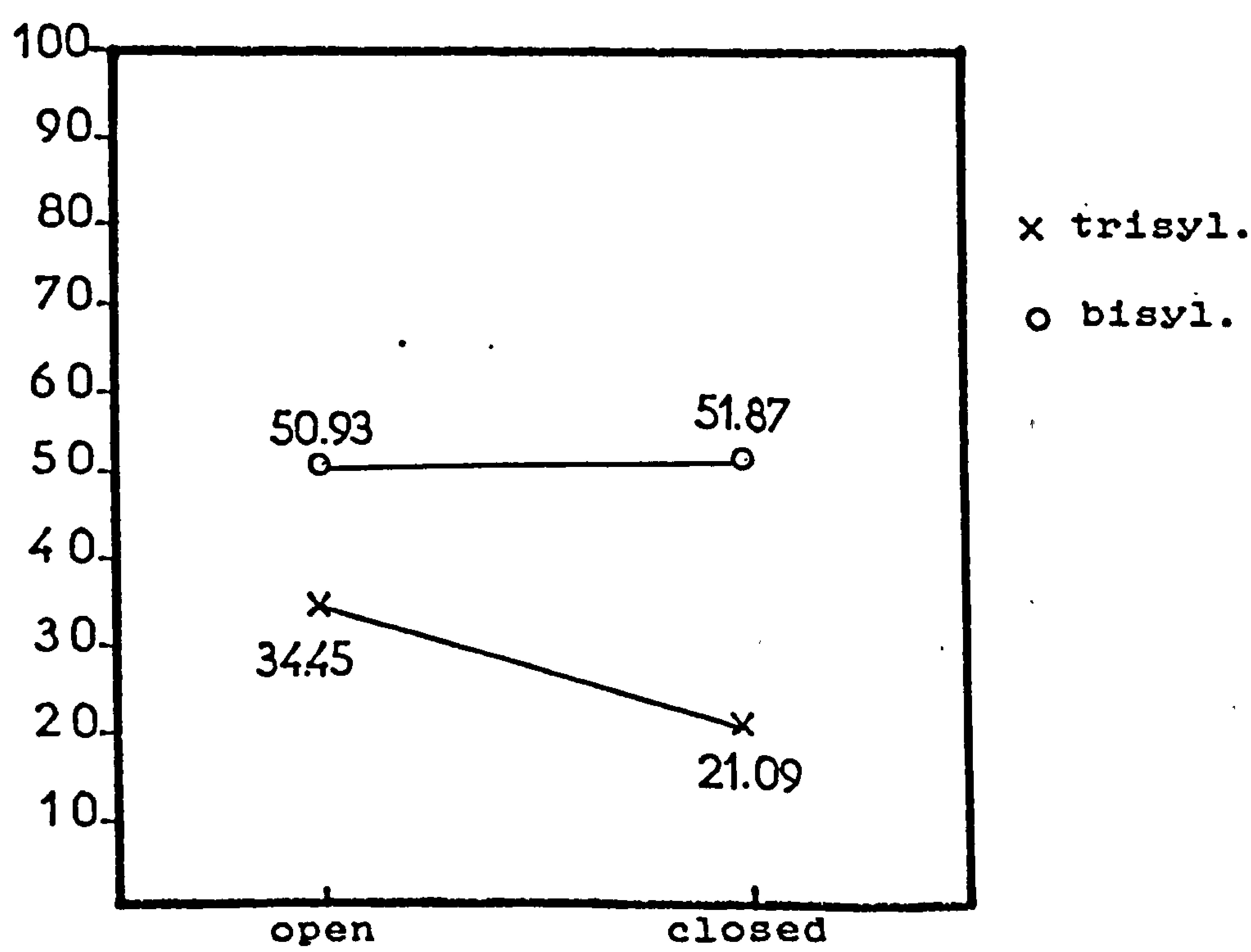
The interaction between Age and the preceding syllable was, however, significant both by Ss (F_1 (1,110) = 5.31,p <.02) and by materials (F_2 (1,20) = 6.17,p <.02), though Min F' ((1,76) = 2.85) did not attain significance (see Figure 5.3.G).

The Age x Preceding Syllable interaction, though not a strong one, could be interpreted as reflecting the fact that while performance by adults varied with whether the target syllable was preceded by an open (41.09%) or closed (54.46%) syllable, the children did not respond significantly better when the preceding syllable was open (37.33%) than when it was closed (38.15%). Individual Scheffé comparison tests disclosed that children performed worse (p <.05) than the adults only when the target was preceded by a closed syllable.

The advantage for targets preceded by a closed syllable was not expected, particularly in the light of Experiment 2 which showed that



Experiment 3 - Fig. 5.3.G: Mean percentage correct responses as a function of age and the type of syllable preceding the target syllable



Experiment 3 - Fig. 5.3.H: Mean percentage correct responses as a function of length of stimuli and the type of syllable preceding the target syllable closed syllables elicited significantly more errors than open. Closer examination of the data, however reveals two reasons that might help explain this finding. First, twice as many preceding syllables were open (N = 16) than closed (N = 8). This could mean that the greater the number of syllables, the greater the opportunity for errors. Second, of the 16 items in which the target syllable was preceded by an open syllable, 10 were trisyllabic and only six were bisyllabic . Conversely, of the eight items in which the target syllable was preceded by a closed syllable, six were bisyllabic and only two trisyllabic [15]. This suggests that the possibility that better performance obtained on closed syllables was perhaps mainly due to the fact that they were located in <u>bisyllabic</u> items which the previous analysis had shown to be less problematic than trisyllabic. In other words, an interaction between length of stimuli and type of preceding syllable could be suspected.

To investigate this possibility, an unequal cell-size four-way ANOVA (Age x Literacy x Length x Preceding Syllable) was performed. This indicated that the interaction Length x Preceding Syllable was just significant by <u>Ss</u> (F_1 (1,110) = 3.94,p <.0.04) and did not quite attain significance by materials (F_2 (1,20) = 3.90,p <.0.06). No other interaction was reliable. Although only marginally reliable, the Length x Preceding Syllable warrants explication.

LENGTH				
	Bisyllable		Trisyllable	
	Open	Closed	Open	Closed
CHLIT	81.24 (10.51)	70.48 (17.62)	53.53 (5.63)	21.87 (13.25)
CHILT	16.93 (6.10)	12.03 (2.26)	9.44 (5.75)	8.33 (3.93)
ADLIT	81.93 (16.17)	87.49 (12.64)	51.49 (27.62)	50.00 (0.00)
ADILT	23.60 (13.34)	37.49 (12.26)	23.22 (10.24)	4.16 (5.89)

EXPERIMENT 3 - Table 5.3.6: Mean percentage correct responses as a function of Age, Literacy and Length of stimuli (bi- v trisyllabic) and Syllable Type (open v closed). Standard deviations are in parentheses.

Examining the individual means which appear in Table 5.3.6, it is notable that the difference between closed and open syllables was more marked when these were contained in trisyllabic (34.45% for open v 21.09% for closed) than in bisyllabic (50.93% for open v 51.87% for closed) words. Furthermore, the difference between closed syllables contained in bisyllabic and those contained in trisyllabic stimuli was greater (51.87% v 21.09%) than that between open syllables contained in bisyllabic and those contained in trisyllabic (50.93% v 34.45%). Figure 5.3.H summarizes this result. Taken together, the results suggest that performance correlating with preceding syllable type was essentially an artefact of word Length.

Summarizing the results, the data are very straightforward, but do not correspond to the findings observed in Experiment 2. This present task has consistently and quite convincingly distinguished the literate

Ss from the illiterate ones with the latter being markedly outperformed. Indeed the literate children reliably performed better than the illiterate adults. Though the age effect was also found to be reliable, no min F' for age achieved statistical significance. The source of this rather unconvincing effect was attributed to the very poor scores obtained by the illiterate children which depressed the overall means for the child Ss considerably, thus contributing disproportionately to the significance of the age effect. These results were further borne out by correlation tests on the child data which revealed that of the two variables involved, the stronger predictor of final syllable awareness for children was literacy.

Analyses were also carried out to determine whether identifcation of the final syllable was affected by two linguistic variables, namely, the length of the stimuli in syllables and the type of syllable preceding the target. It was expected that given the position of the target syllable (final position), it would be less dificult to extract when it was part of a bi- than a trisyllabic word. It was also expected that a target syllable would be more successfully recognised when the adjacent syllable was open rather than closed.

In general, performance was impaired on longer (ie trisyllabic) stimuli. The robustness of the length effect here was further highlighted by the absence of an age x length interaction. On the other hand, a literacy x length interaction indicated that while performance by the literates varied with whether stimuli were bisyllabic or trisyllabic, the illiterates were no more capable of attending to the final syllable when it was part of a bisyllabic than when it was part of a trisyllabic stimulus. This may be attributable to a floor effect among the illiterates.

The effect of Length was further confirmed by findings yielded by the analysis of the second linguistic variable, ie the syllable preceding the target. These indicated that performance on open and closed syllables was dependent on whether they were contained in bisyllabic or trisyllabic, with better performance on the former.

3. Comparison with Experiment 2 (Initial Syllable)

Considered in their entirety, the present findings stand in sharp contrast to those in the previous experiment. Performance with first syllable identification was high and no differences between either age or literacy groups were observed. Nor were there any length effects. In contrast, the present experiment has shown that performance by the illiterate group was fundamentally different from that of the literate group. In what follows we discuss the results from this experiment in the light of findings from Experiment 2.

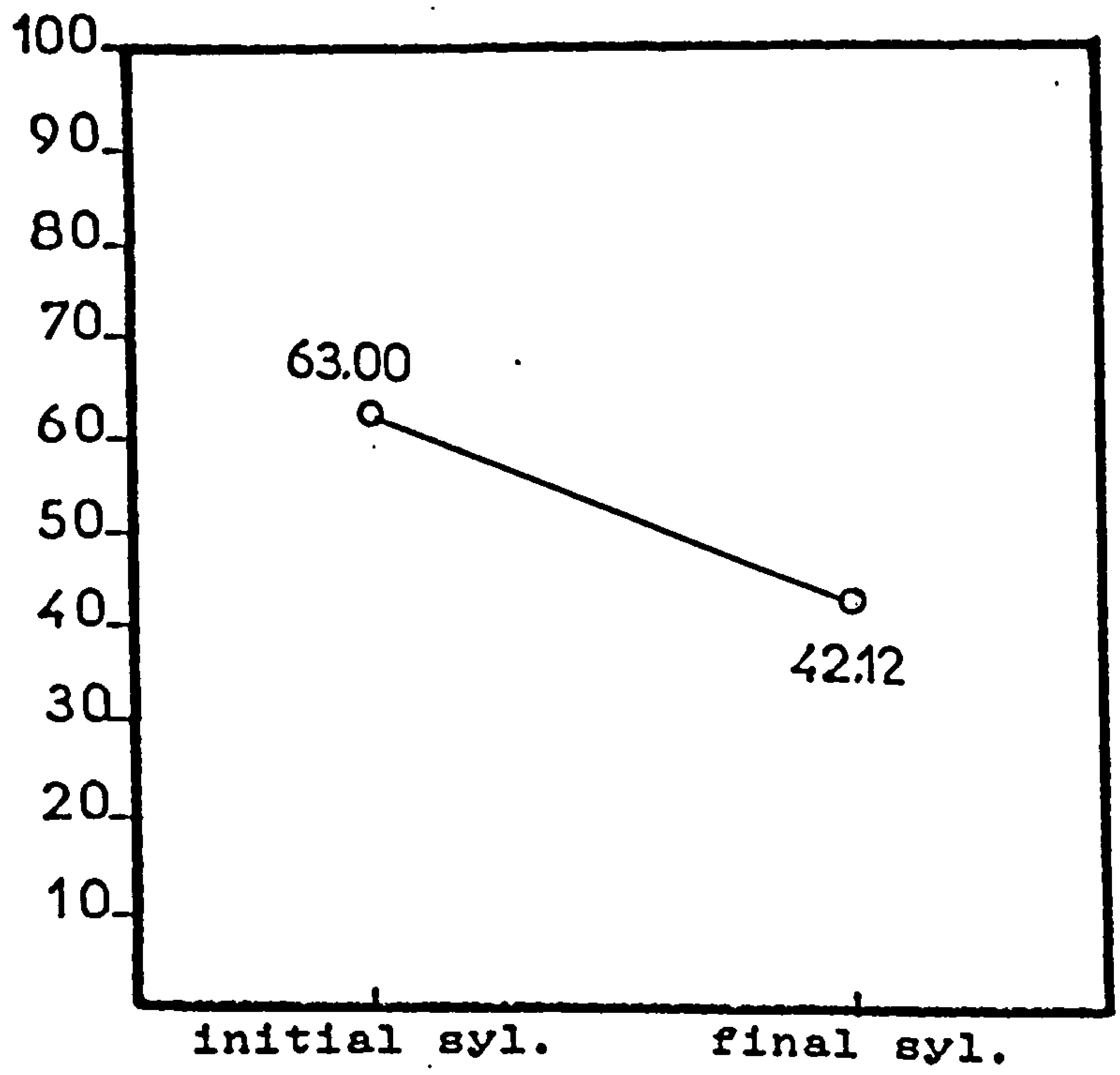
To assess the difference between the two experiments statistically, a four-way subject-based ANOVA was performed with Ss nested in Age, Literacy and Group and crossed with Task. The design was as follows: 2(Age (Child, Adult)) x 2(Literacy (literate illiterate) x 2(group (A, B)) x 2(Task (initial, Final)).

As expected this analysis confirmed the trends that are displayed in Table 5.3.7. It yielded a significant main effect of Task (F_1 (1,112) = 55.47,p <.001) (see Figure 5.3.I) as well as a significant main effect of literacy (F_1 (1,112) = 55.47,p <.001) and no effect of age (F_1 (1,112) = 3.48,p >.06). A reliable Task x Literacy interaction was also recorded (F_1 (1,112) = 33.26,p <.001). No other interaction was found significant.

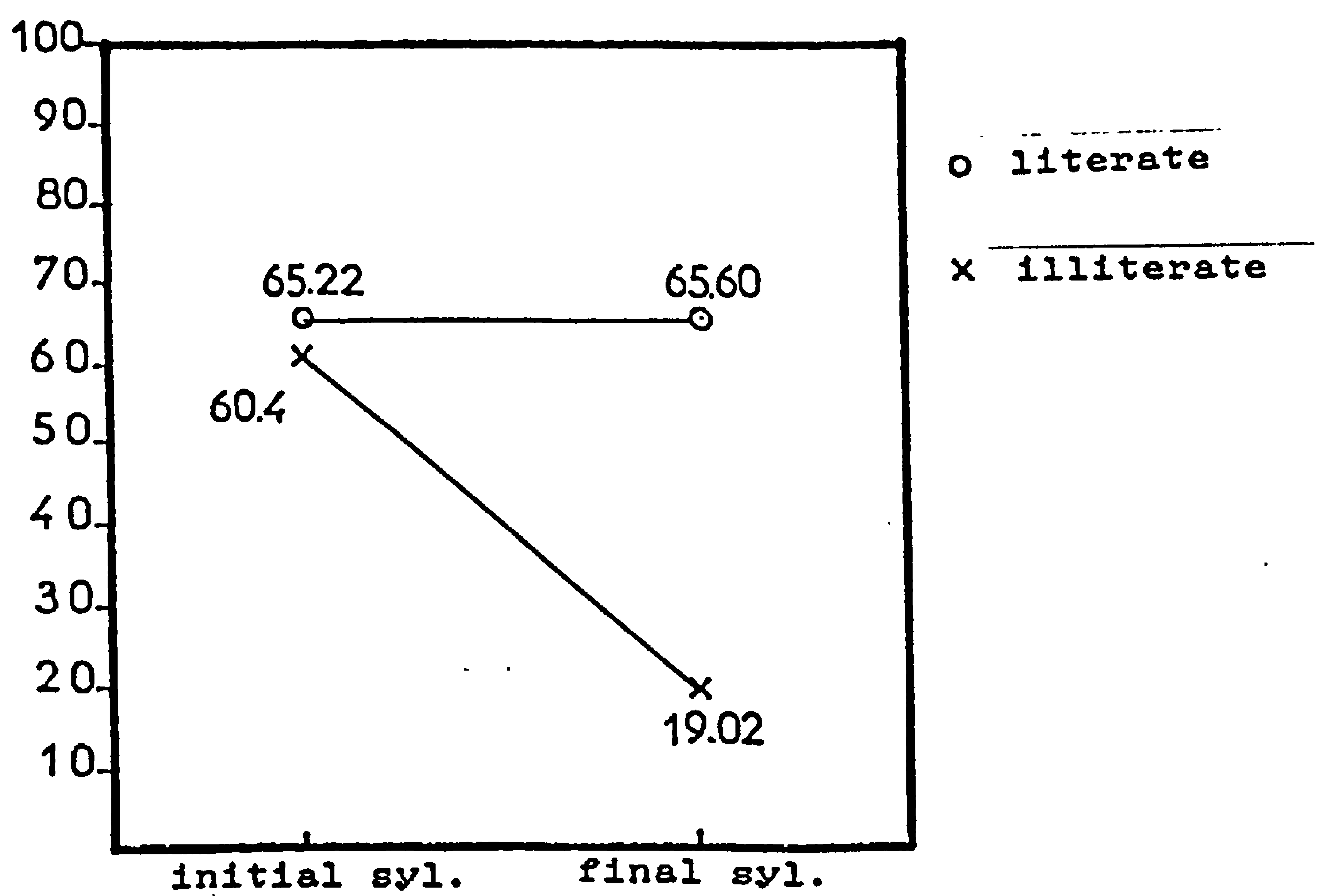
	TASK			
	Initial Syllable		Final Syllable	
CHLIT	61.10	(19.70)	62.06	(20.89)
CHILT	63.18	(26.05)	12.70	(25.09)
ADLIT	70.10	(18.49)	68.39	(17.83)
ADILT	57.63	(22.94)	25.34	(27.89)

EXPERIMENT 3 - Table 5.3.7: Mean percentage of correct responses as a function of Age, Literacy and Task (Initial Syllable Identification v Final Syllable Identification). Standard deviations are in parentheses.

As can be seen in Table 5.3.7, the literate Ss did not evidence a difference in performance to the target syllable in either initial or final position. In contrast, while both groups of illiterate Ss performed as well as the literates on the initial syllable, their performance on the final syllable was considerably poorer. This difference is all the more remarkable given that both experiments employed not only the same Ss and the same procedures, but also the same stimuli.



Experiment 3 - Fig. 5.3.I: Mean percentage correct responses as a function of task (initial syllable vs. final syllable)



Experiment 3 - Fig. 5.3.J: Mean percentage correct responses as a function of task and literacy

As Figure 5.3.J shows, the Task x Literacy interaction was essentially caused by the fact that illiterates' performance varied from initial ($\bar{X}$ = 60.40%) to final ($\bar{X}$ = 19.02%) target, whereas the literates performed similarly regardless of syllable position ($\bar{X}$ = 65.22% and 65.60%). Post-hoc (Scheffé) tests revealed that illiterates performed worse than the literates only when the target was a final syllable.

The finding that the final syllable proved to be less available for conscious manipulation than the initial syllable was not totally unexpected. It was alluded to in the introduction to this experiment. What was not expected, however, was that performance would vary with literacy with the effect of position observed only for illiterate Ss.

The discrepancy between the literate and the illiterate Ss cannot be ascribed to an artifact of the experimental design since all Ss had already displayed their ability to identify and extract word-initial syllables. Nor can it be ascribed to factors within stimuli alone since the two linguistic variables which were examined (ie length of stimuli and structure of the syllable preceding the target) were found to affect the literates more than the illiterates. It must, then, be ascribed to some difference in difficulty between the initial and final positions of the syllable. This interpretation implies, of course, that unlike the initial syllable, the final syllable cannot be easily brought to conscious awareness.

While the present experiment makes no claim to providing direct support for research in the area of speech perception, it is evident that the findings sit comfortably with the view that the initial syllable is employed to access the mental lexicon. We have already cited work by Cole (1973), Marslen-Wilson and Welsh (1978), Cole and Jakimik (1980), Marslen-Wilson and Tyler (1980), Taft and Foster (1976) and Foster (1979) which claim that a word is accessed on the basis of its initial syllable. This implies that the final syllable is not necessary for making this recognition. And because it is not, that syllable might be ignored altogether. Similarly, it may be the case that, being uninformative, the final syllable is totally transparent and thus, tends to escape the awareness of Ss by precluding them attending to it "on demand", as it were, in a metalinguistic task like the one discussed here.

It follows, then, that literate Ss may not rely on auditory stimuli alone, but may have a representation of the written form or the orally presented stimulus and thus, may possess more cues for their judgments. This additional code, we think, may even play a role in the tacit, automatic perception of speech in the competent literate. This was for example alluded to by Foss and Swinney (1973) who note that in the case of phoneme monitoring, some Ss' decisions may occur via an examination of the spelling of the identified lexical item or its first syllable. "The letter (emphasis mine) will then be a unit that is identified and enters into conscious awareness" (p 254). This is a very important issue and will be discussed at length in subsequent chapters when we examine the general issue of the impact of literacy and in particular, the role of orthography.

A view of Ss' approach to the task comes from the qualitative analysis of the data which indicate that Ss' errors were distributed nonrandomly. There were three major error categories:

(i) Ss' responses contained the initial syllable instead of the final.

(ii) Ss' responses contained the last two syllables.

(iii) Ss' responses were orthographically contaminated.

It is worth noting here that the majority of errors made by the literates belonged to the second category (64.63% of the time, with 54.83% for the children and 81.31% for the adults). The negative effect of being a beginning reader emerged here too. Of the literate children's errors, 32.25% involved the children responding with the final segment instead of the final syllable.

The illiterate Ss contributed almost exclusively to the errors of the first category (ie responding with initial syllable) [16]. This accounted for over half of their errors, with the remaining mainly belonging to the second category (ie responding with the last two syllables).

Finally, the present findings do not seem to be compatible with Slobin's (1973) proposal (Operating Principle A) that the 'end of words' is salient for early phonological strategies in language acquisition. We had hypothesised, it will be remembered, that although Slobin's principle was meant to be an explanation for suggested universals in the ontogenesis of grammar, it did not seem implausible that this or a similar principle might remain as general heuristics even in children who have acquired their language. A closer examination, however, suggests that there may be no necessary conflict since the studies concentrated on two different aspects of "end of word". Whereas the present experiment considered awareness of the final syllable (practice items were controlled for number of syllables), Slobin's "end of word" may mean "complement of the first syllable" or the "remainder". Some of the examples offered by Slobin (eg 'sayim' (two syllables) from Hebrew 'mixnasayim') confirm this interpretation.

The second research area for which this experiment did not contribute some support is rhyme. Earlier in this chapter, we interpreted some data on rhyme (eg Juszcyk, 1977; Lenel and Cantor 1981) as supportive evidence for the availablility of the final syllable for selective attention and manipulation. One explanation for this incompability, would be to suggest that the focus part of the word in rhyming may include almost all the word, not just the last syllable. Thus, although it is often said that the rhyme is that part of the syllable that 'rhymes', in the strict sense this is only true of masculine rhyme where we can indeed observe that precisely that part of the syllable with which we are concerned here must be identical for the rhyme to be successful. But there are also other forms of rhyme involving two syllables (feminine rhyme) or three syllables (extended rhyme). It is also notable that words in line-end position of rhymes are frequently accented in verse. Apparently, nursery songs altered so as to remove the rhymes remain acceptable as long as the rhythm is preserved (Savin, reported in Kavanagh et al, 1972, p 327).

Another reason for the incompatibility of results is that appreciation of a rhyme does not seem to require a very analytic attitude. Thus, while it may demonstrate that illiterate listeners are able to categorize words on the basis of their sounds, (eg 'bill' is like 'fill'), it does not show that the judgment is based on identification of a common syllable or segment. One can produce words that rhyme, knowing that they sound similar but not knowing <u>how</u> they sound similar. The finding that kindergarten children are unable to produce rhymes 'on demand' (Calfee <u>et al</u>, 1972) is consonant with the argument that 'rhyming' in verbal play is not a conscious activity. Rather, it may be viewed as a manifestation of spontaneous creative manipulation of language. In sum, to appreciate rhyme does not seem to require a very analytic attitude. But such thinking is more involved in final syllable identification.

To summarize, metalinguistic patterns yielded by both Experiments 2 and 3 seem to parallel those for speech comprehension. In ordinary listening we do not seem to monitor for final syllables, but for initial syllables. Inside the 'exeperimental laboratory', however, when <u>S</u>s are required to monitor for final syllables, literacy is used as a mediator. It is an important determinant of different mental representations. It would seem that, in addition to the coding dimensions already available to <u>S</u>s (phonemic, morphemic, semantic, syntactic), literacy may provide an additional coding dimension in the form of a visual or abstract representational system which, can provide more cues to retrieve (because aware of) the final syllable. Put simply, literates possess a psychologically compelling code which helps them 'see' and, therefore, intentionally manipulate what they hear.

In any event, if final syllables can be attended to unconsciously, it seems that it is not a general principle that they can be manipulated knowingly unless one is literate. Having a 'concrete' picture in one's mind seems to facilitate metalinguistic processes.

V. Experiment 4

The present experiment on syllables was mainly inspired by the existence of linguistic games [17]. Language games such as Pig Latin or Sorsik Sunmakke (Sherzer, 1970) are metalinguistic activities. They have been a useful source of evidence concerning the linguistic and psychological representation of certain properties of the grammars internalised by their users. For example, Halle (1962) used Pig Latin to illustrate the importance for dialectologists of comparing grammars rather than merely superficial characteristics of similar dialects. In the same vein, Sherzer (1970, 1976) argued for abstract phonological representation on the basis of a language game called Sorsik Sunmakke (talking backward) played by the Cuna Indians of Panama. The game consists of moving the first syllable of a word to the end of the word. Thus, <u>dage</u> 'come' -> <u>geda</u>. Recently, McCarthy(1981) and Al-Mozaini (1981) have used evidence from a language game of Bedouin Hijazi Arabic to argue for the notion that the root consonantism (ie the discontinuous string of root consonants) is a single unit at some level of representation in Semitic languages. (Also see a very recent study by Hombert (1986)).

In psycholinguistic research, new language games have been devised and Treiman (1983), for example, taught <u>S</u>s word games to explore the hypothesis that onsets and rhymes function as cohesive units.

As metalinguistic activities, language games display the speaker's awareness of the structure of language.

Rules employed in these languages seem to operate on segments, syllables or words. According to Farb (1974) almost all the operations are based on the syllable (see also Sherzer, 1976) and this is another reason for the design of the present experiment. Common operations in language games include reduplication, infixation, and resequencing (or rearrangement). The present experiment uses the last of these to explore Ss' ability to manipulate syllables.

As detailed in the methodology section (see further below), this experiment is made up of two tasks, a Recognition (REC) task and a Production (PRO) task. In the PRO task, Ss were required to scramble the syllables of a word. In the REC task, the operation was reversed: Ss were presented with scrambled words and were required to restore their normal syllable sequence.

This experiment assumes that before Ss can permute syllables, they must be able to extract and separate them. Similarly, to reverse the sequence of syllables in a word (or nonword) deliberately, one must know what the syllables are.

A. Method

1. Tasks

As noted above, the experiment reported here used both a recognition (REC) and a production (PRO) task in a complementary manner.

In the (REC) task, Ss were required to identify a meaningful word the first and last syllable of which had been interchanged. Thus, input 2-1 (eg bada) yields 1-2 (ie daba) and input 3-2-1 (eg ramisa) yields 1-2-3 (ie samira).

In the PRO task, the operation was reversed. Ss were presented with a real word and were required to alter its normal sequencing by scrambling its syllables. Details regarding the procedure are given further below.

There are at least three reasons for using both a REC and a PRO task. First, in language acquisition studies, recognition and production methods are usually distinguished in terms of degree of difficulty. Our aim was to determine whether metalinguistic abilities are differently reflected in recognition and production tasks. Secondly, there is some evidence that, contrary to expectation, recognition tasks may not elicit better performance than production tasks. Warden (1981) draws attention to a piece of research by Clark and Garnica (1974) in which they found considerable confusion in children's comprehension of the verbs 'come' and 'go' until nine years of age. However, using a production task, Richards (1976) found that over 90% of four-year-olds had an appropriate use of these decitic verbs. Similarly, Chomsky (1969), studying comprehension of the verbs 'ask' and 'tell' in children between five and ten years of age, found that the younger children consistently responded correctly when instructed to tell someone something, but they also imposed a 'tell' interpretation on 'task' instructions. However, after varying the interpersonal context of Chomsky's task, Warden (1980) found just the opposite, that five-year-olds asked when instructed to ask, but also asked when instructed to tell. Thirdly and finally, common observation that comprehension precedes production may be explained by the fact that comprehension, being cognitively demanding, may adequately proceed from an "unanalysed representation of the system" while aspects of the production await "analysed knowledge" (see Bialystok, 1982). In metalinguistic research, we are interested in just such 'analysed knowledge'.

2. Materials and Design

Two sets (A and B) of 18 real words each were constructed and constituted the basis for sitmuli in both tasks. In order to make the reversed words (REC task) and the real words (PRO task) of comparable difficulty, the following design was adopted: reversed words for sets A and B (ie REC task) were respectively derived from the real words in sets B and A (ie PRO task). Thus, reversed 'ramisa' from set B (REC) was derived from real 'samira' in set A (PRO). A full list is to found in Appendix C.

A Latin square design was employed such that Ss hearing set A words in the REC condition were assigned stimuli from set B in the PRO condition, and those hearing set B in REC were assigned stimuli from set A in PRO.

In order to control for the effects of length (in syllables) and type of syllable (open or closed) the materials were designed as follows:

(i) Each set of 18 stimuli contained nine two- and nine three-syllable-stimuli.

(ii) Two-syllable stimuli were varied systematically according to whether their first and last syllables were both open (O + O), one open and one clsoed (O + C) or one closed and one open (C + O). There were items of each type in each set. However, in view of the predicted difficulty of these tasks and the assumed difficulty of closed syllalbes, all three-syllable stimuli (with the exception of two items, one in each set) were of the O + O type.

In order to minimize the processing involved, further constraints were observed:-

(i) Both onsets and codas of the syllables contained the minimum possible number of segments allowed by the phonology of the language. Thus, all open syllables were of the CV type and all closed syllables were of the CVC type (see footnote 8).

(ii) Medial syllables in three-syllable-stimuli were never interchanged in the REC task. The input was always 3-2-1.

(iii) In the PRO task, no particular combination of syllables was required for three-syllable-stimuli. That is, Ss could permute syllables into any order they chose. All stimuli were given in a fixed order and all Ss heard 18 stimuli each.

2.1 Procedure

Both tasks employed a version of the modified knock-knock game technique first introduced in Experiment 2. The rule for playing this version of the game is quite straightforward. For the REC task it consists of interchanging the first syllable with the last syllable of a non-word which yields a real word (ie the target word to be identified). The routine for the REC task proceeds as follows:

1E	Knock-Knock
2S	Who's there?
3E	ridfa
4S	ridfa who?
5E	Now, you guess!
6S	[gives response, ie farid] = This is the response which is scored.

In this version of the knock-knock game technique, line four ensured that S has correctly perceived the stimulus.

For the PRO task, the procedure was similar except that here S and E alternated roles. Furthermore, since the task involved elicited production rather than free production, E proposed stimulus first before one proceeded. Thus:

E proposes a real word (eg samira)

1S knock-knock

2E who's there?

3S ramisa (or any other possible combination):
This is the response which is scored.

4E ramisa who?

5S Now you guess!

6E [gives response]

In general the procedure went much faster because, as the game proceeded Ss did not have to go through the whole routine. Thus, except for the very young children in the sample, lines four, five, and six were often skipped particularly towards the end of the session.

During the practice session two types of stimuli were employed to help Ss to acquire the rules of the syllables resequencing game. First, the game was played with digits (eg input 3-2-1 in REC task -> 123), then with words (reversed words for the REC task and real words for the PRO task). These word stimuli were graded in difficulty in terms of their length and the structure of the syllables they contained.

The two tasks were always tested in the same session with REC always preceding PRO. In the REC task three-syllable words were administered last because it was expected they would be difficult and thus cause discouragement. No such constraint was observed in the PRO task.

B. Results and Discussion

We shall discuss first, the results of the REC task, and then the results of the PRO task. Finally, we shall compare the two measures and examine both quantitatively and qualitatively some of the trends observed.

1. REC Task

1.1 Subject Variables

1.1.1 Scoring. The scoring principle was similar to the previous experiment. A response was scored when the target was identified (ie when the reversed input was rearranged into the correct meaningful word). In the case of trisyllabic words, no combination other than the target word was scored. It will be recalled that only one correct combination was possible.

The relevant data representing the mean percentage of correct responses and standard deviations for each age and literacy groups are displayed in Table 5.4.1.

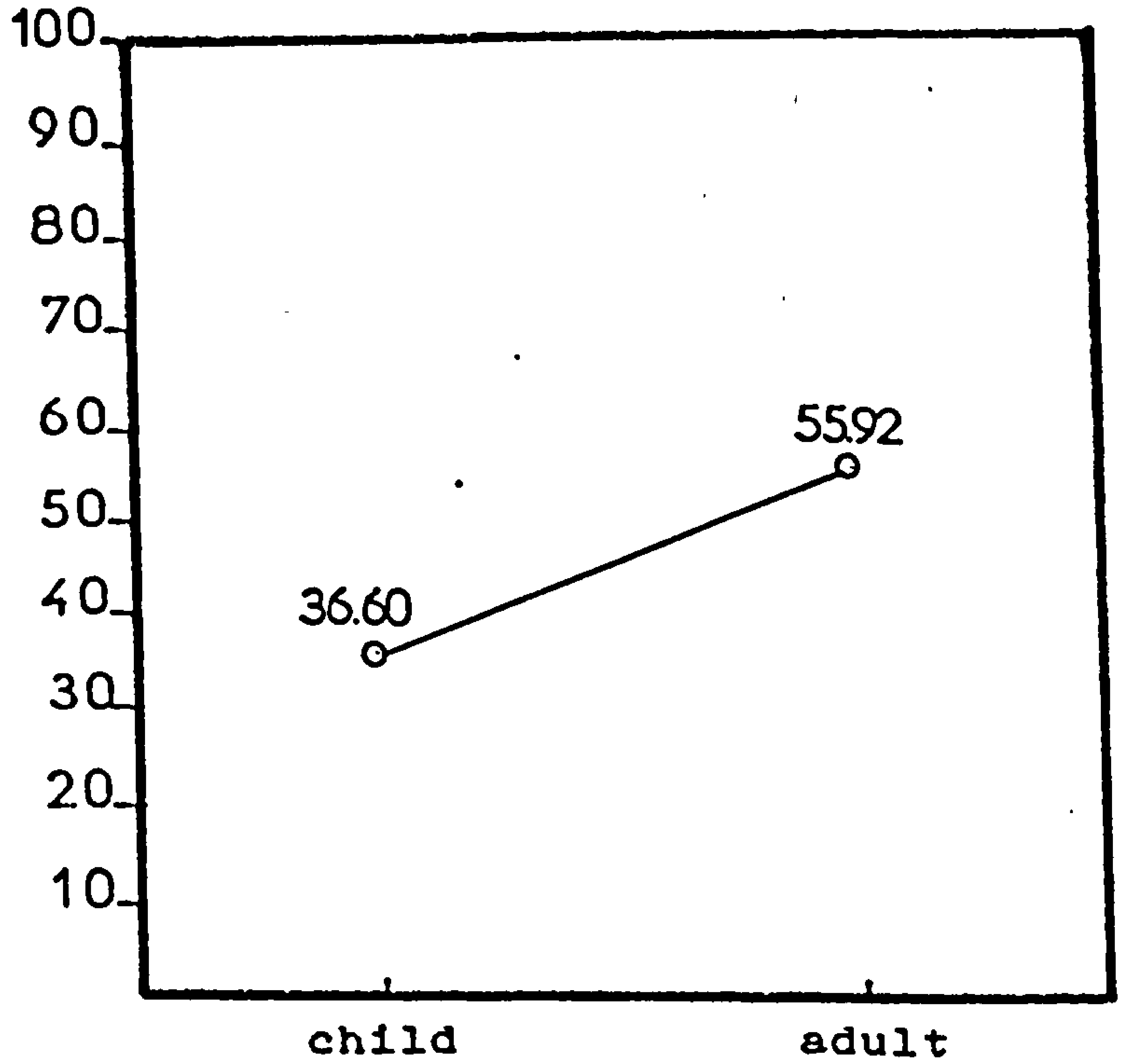
		LITERACY			
		Literate		Illiterate	
AGE	Child	58.25	(22.45)	14.96	(14.61)
	Adult	81.71	(13.07)	30.13	(26.57)

EXPERIMENT 4 - Table 5.4.1: Mean percentage of correct responses for each Age and Literacy group. Standard deviations are in parentheses.

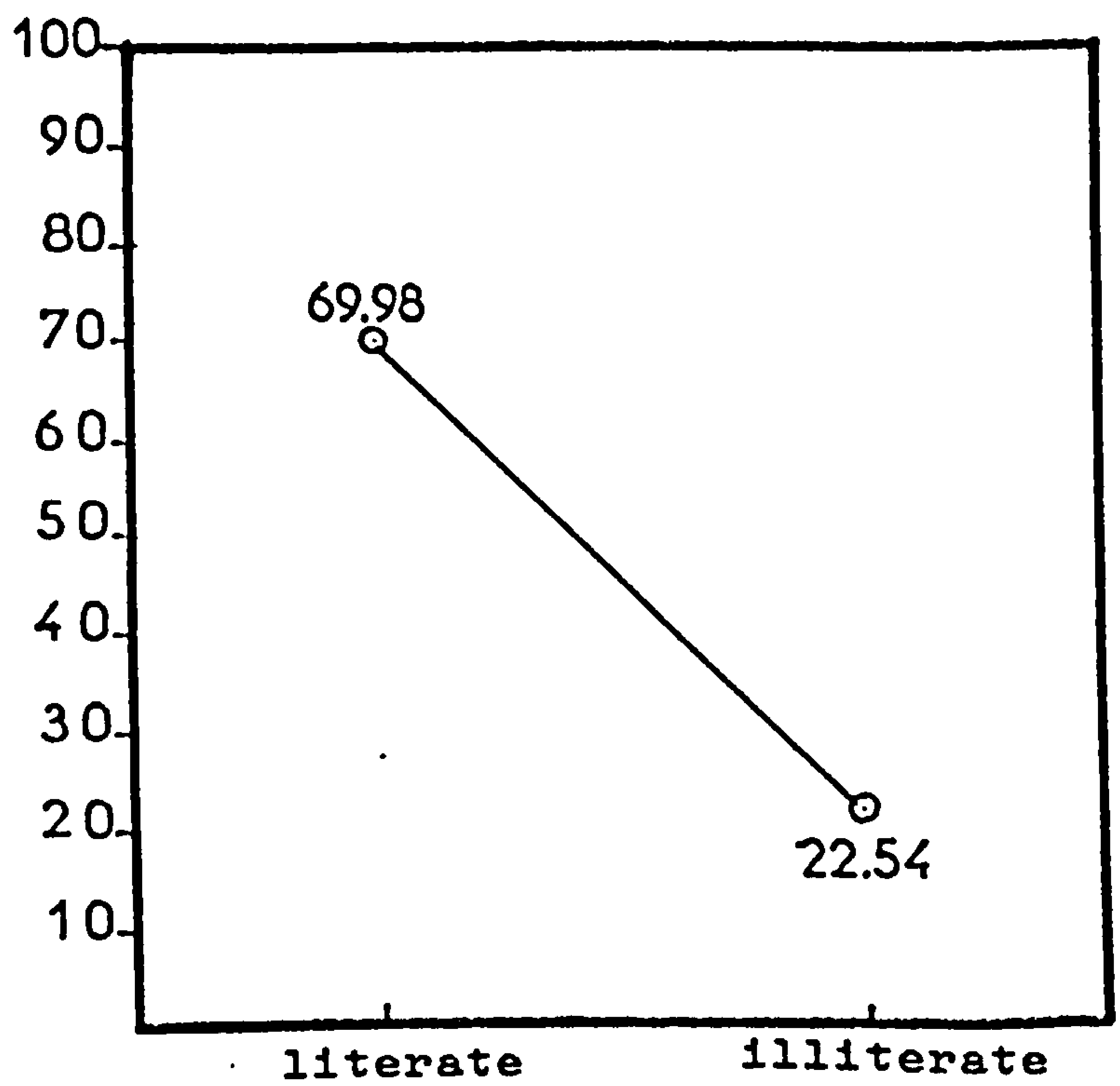
1.1.2 Analysis and Findings. ANOVA. The data was analysed as in the previous experiment. Raw scores were submitted to two separate three-way (one by Ss and one by stimuli) ANOVA's with Age, Literacy and Group (each with two levels) as the independent variables.

As portrayed in Figure 5.4.A, the effect of Age was significant both by Ss (F_1 (1,109) = 26.30,p <.0001) and by stimuli (F_2 (1,34) = 124.55,p <.0001) yielding a reliable min F' (1,40) = 21.7,p <.01 [18]. Means for the child and the adult Ss were 36.60% and 55.92%, respectively.

As in Experiment 3, the effect of Literacy was by far the stronger of the main effects, producing very large F- ratios both by Ss (F_1 (1,109) = 158.65,p <.0001) and by stimuli (F_2 (1,34) = 333.80,p <.001); min F' (1,38) = 107.53,p <.001. Means were 69.98% and 22.54% for the literates and the illiterates, respectively. Figure 5.4.B plots these results.



Experiment 4 - Fig. 5.4.A: Mean percentage correct responses as a function of age (Recognition task)

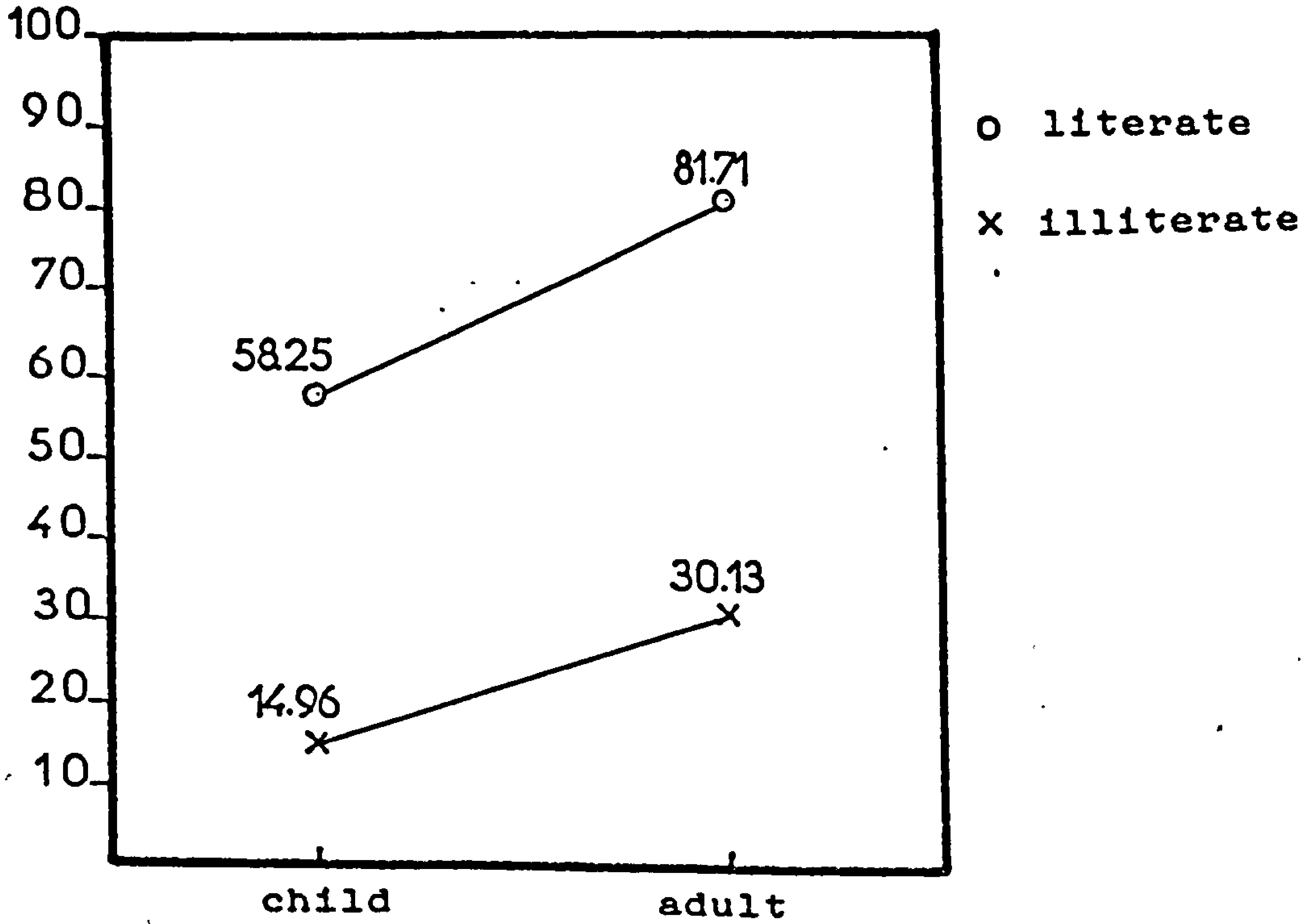


Experiment 4 - Fig. 5.4.B: Mean percentage correct responses as a function of literacy (Recognition task)

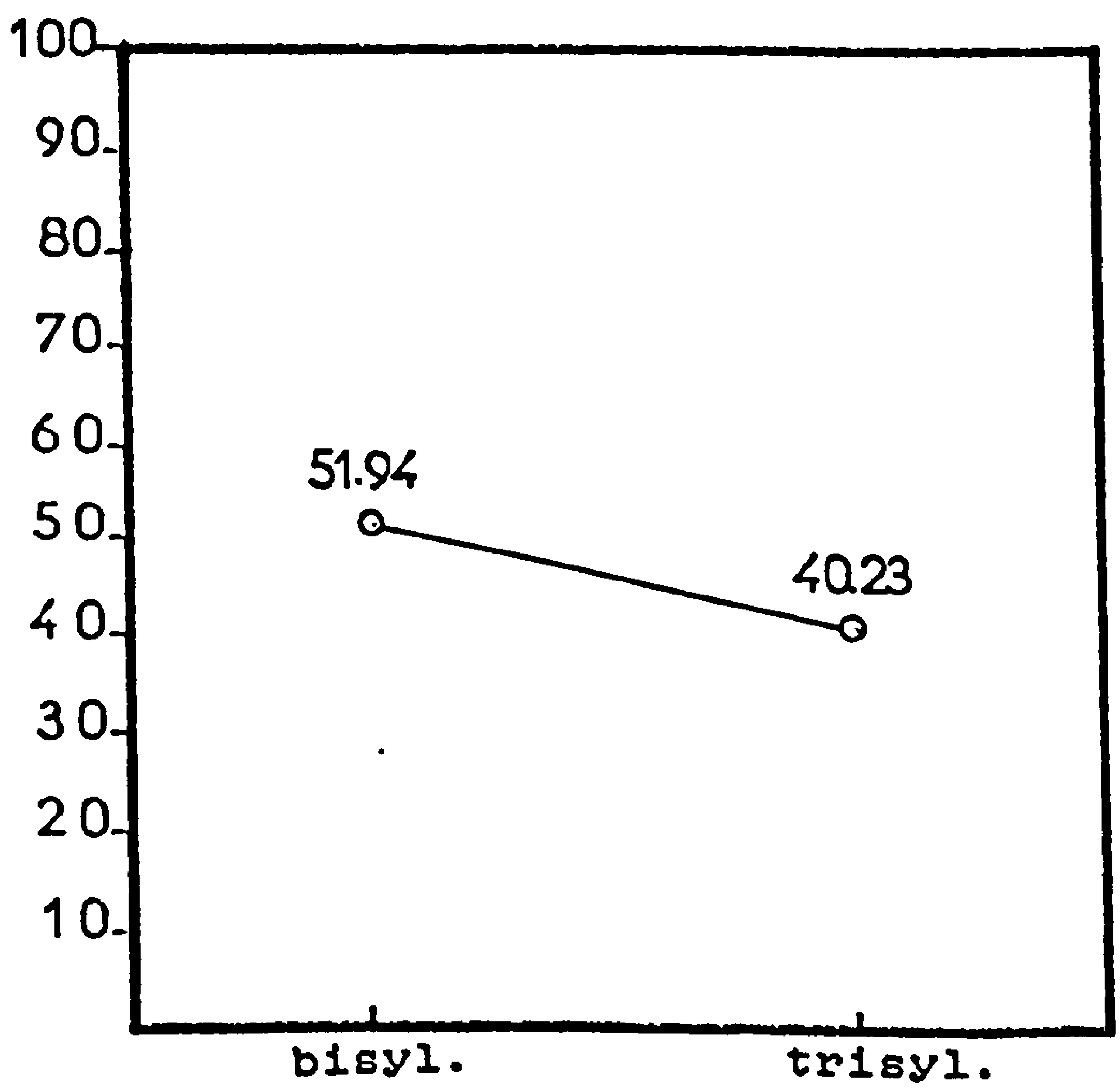
The pattern of results here was not markedly different from that observed in Experiment 3 (ie Final syllable identification). Thus, overall, the adults were more successful than the children and the literates more than the illiterates.

The Age x Literacy interaction was not found to be reliable by Ss (F_1 (1,109) = 1.21, n.s) and just approaching reliability in the by materials analysis (F_2 (1,34) = 3.84,p >.05). Although not quite significant, this result is displayed in Figure 5.4.C for purposes of comparison with the previous experiments. As can be seen in this Figure, the literacy effect was more marked in the adult Ss than in the child Ss. The Age effect was more marked in the literate Ss than in the illiterates. This can be safely attributed to the superior performance of the literate adults. In fact, a closer examination revealed that it was the literate adults ($\bar{X}$ = 81.71%) who increased the grand mean for the adult group, while the illiterate children ($\bar{X}$ = 14.96%) depressed the results dramatically for the child group; otherwise the literate children ($\bar{X}$ = 58.25%) performed better than either illiterate group (30.13% and 14.96% for adults and children, respectively).

Correlations. Correlations assessed the three-way relationship between the children's chronological age, their level of literacy and their performance on the present task. They revealed a very high degree of association between the children's literacy level and the task score (r = 0.71, t(1,69) = 7.68,p <.01) as well as a significant correlation



Experiment 4 - Fig. 5.4.C: Mean percentage correct responses as a function of age and literacy (Recognition task)



Experiment 4 - Fig. 5.4.D: Mean percentage correct responses as a function of length of stimuli (Recognition task) between age and task score ($r = 0.53$, $t(1,69) = 8.24$, $p < .01$). When, however, the level of literacy as measured by school grade, was held constant in the correlation (ie Age x Task . Grade), the results yielded a negligible partial correlation with age ($r = 0.09$), indicating that the relationship that was shown to exist between the children's age and their performance was mainly caused by their level of literacy. In contrast, when age was held constant, the correlation between level of literacy and performance on the task was much less affected (r Grade x Task . Age) = .56) indicating that performance was relatively independent of the influence of age and continued to be notably related to the child's literacy level.

Correlation tests were also carried out on the literate children's data to determine whether there was any significant change in performance from first to second grade. Though second graders ($\bar{X} = 61.76\%$) appeared to have more successful than first graders ($\bar{X} = 54.93\%$), no significant relationship was to be found to exist between school grade and task score ($r = 0.11$ and $r = 0.03$ with Grade partialled out).

The failure of these correlations to show results seems to indicate that the significant correlation between level of literacy and performance which was obtained for all children was mainly attributable to the difference between the literate and the illiterate Ss. These results are similar to the ones from Experiment 3 and will be discussed together when all three experiments are examined. Now we turn to the linguistic variables which were predicted to affect results.

1.2 Linguistic Variables

It will be remembered that two linguistic factors were expected to have an effect on the recognition task (see design): Syllable Length and Syllable Type. Specifically, it was predicted that trisyllabic stimuli and closed syllables would elicit more errors than bisyllabic stimuli and open syllables, respectively.

To assess these factors, the procedure and method for the statistical analysis were similar to those employed in the previous experiments.

1.2.1 Effects of Length. A four-factor analysis of variance 2(Age (Child, Adult)) x 2(Literacy (Lit, Illit)) x 2(Group (A, B)) x 2(Length (bisyl, trisyl)) was performed twice: first on Ss data with Ss nested in Age and Literacy and crossed with Length and then on materials with stimuli nested in length and crossed with Age and Literacy.

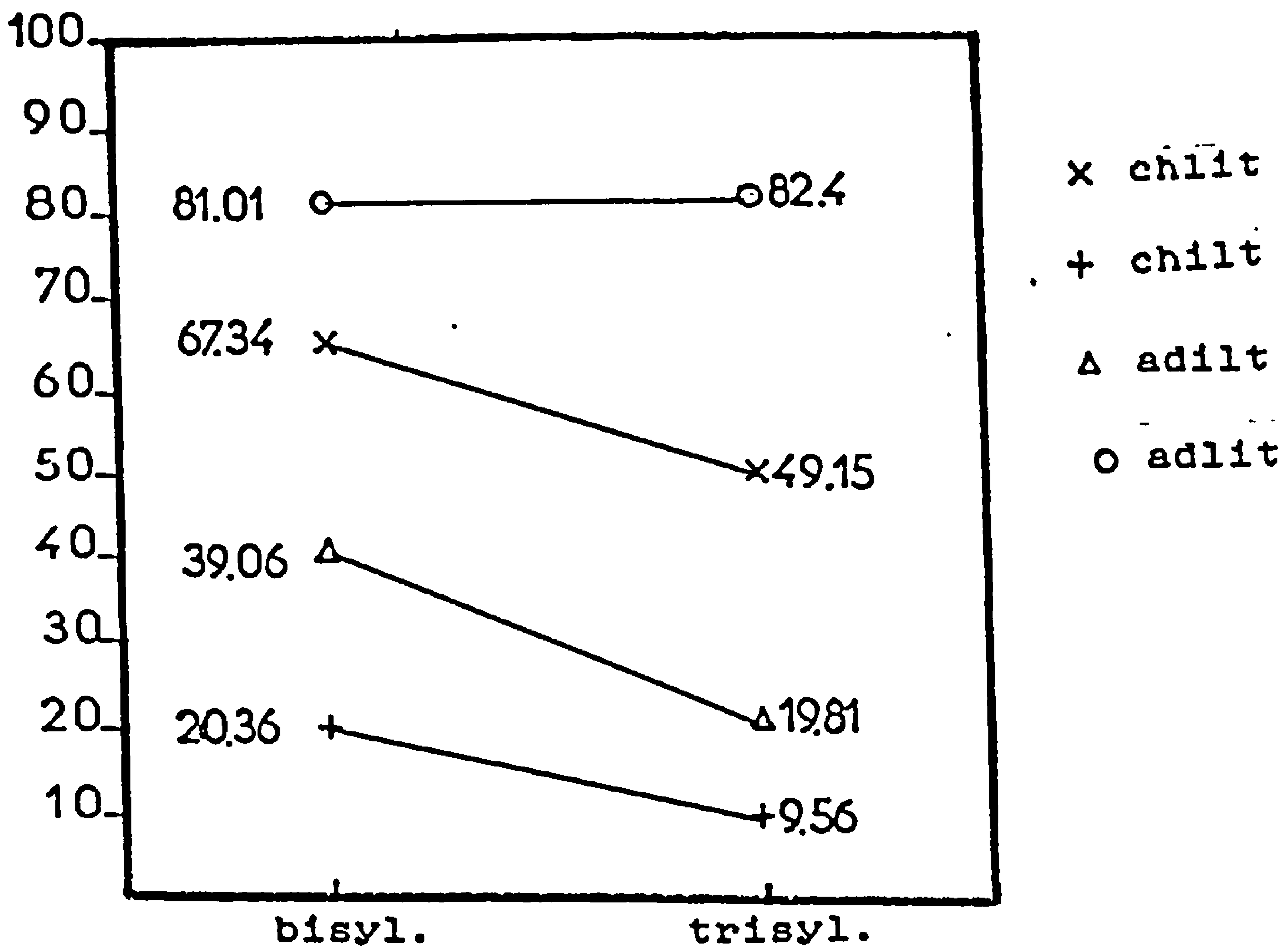
Results of the ANOVA indicated that the overall performance varied with the Length of stimuli (F_1 (1,09) = 29.95,p <.001; F_2 (1,34) = 6.10,p <.01; min F' (1,49) = 5.06,p <.01). Means were 51.94% and 40.23% for bisyllabic and trisyllabic stimuli, respectively. These results are displayed in Table 5.4.2 and depicted graphically in Figure 5.4.D.

LENGTH OF STIMULI	Bisyllabic		Trisyllabic	
CHLIT	67.34	(24.82)	49.15	(28.68)
CHILT	20.36	(19.96)	9.56	(14.42)
ADLIT	81.01	(16.23)	82.40	(14.17)
ADILT	39.06	(31.66)	19.81	(26.11)

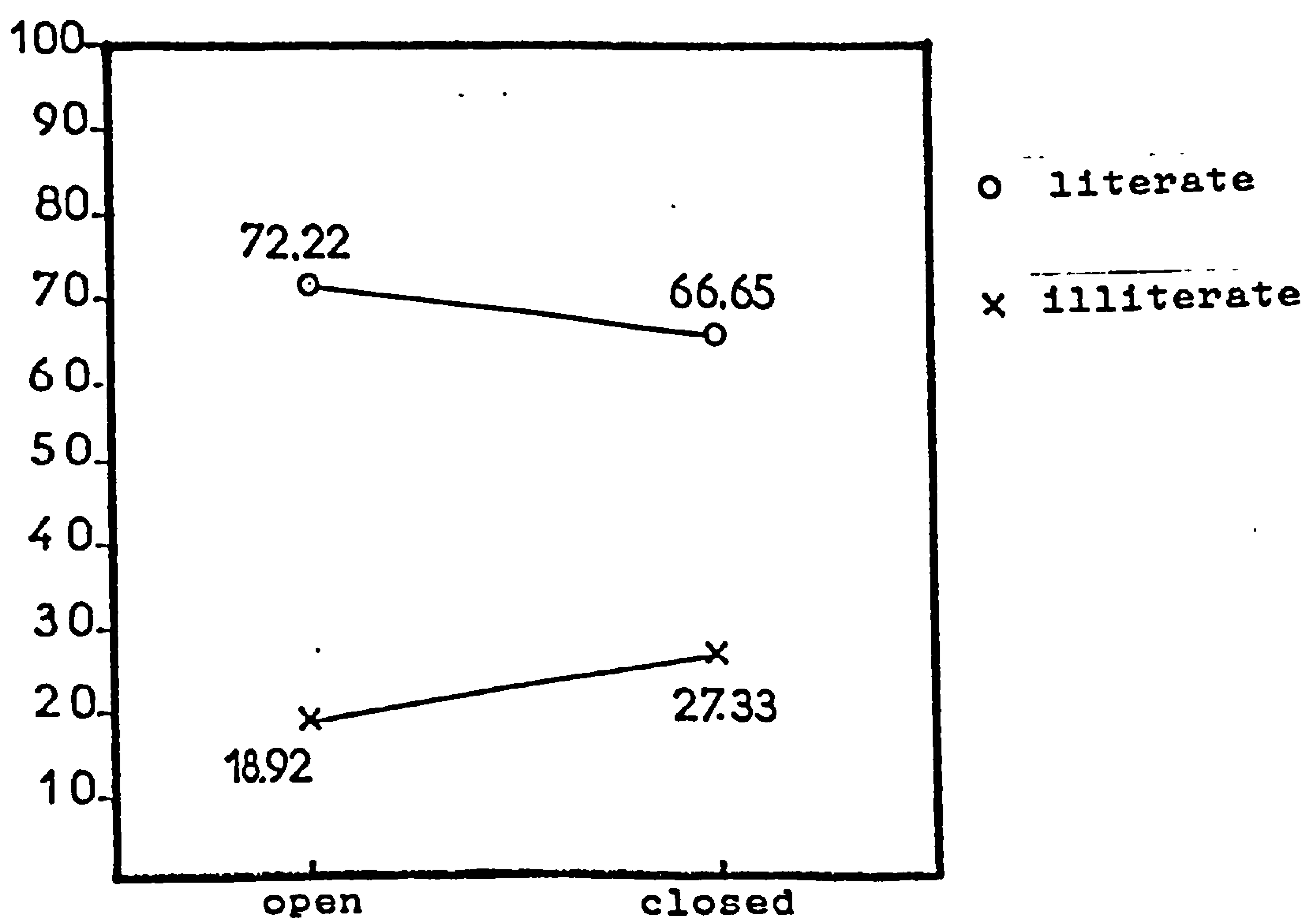
EXPERIMENT 4 - Table 5.4.2: Mean percentage correct responses as a function of Age, Literacy and Length of stimuli. Standard deviations are in parentheses.

This result, however, was tempered by the existence of a three-way Length x Age x Literacy interaction which was found to be very reliable both by Ss and by materials (F_1 (1,109) = 10.72,p <.001); (F_2 (1,32) = 19.73,p <.001); min F' (1,29) = 6.94,p <.01. Means for children and adults were 43.85% v 60.03% for bisyllabic and 29.35% v 51.10% for trisyllabic stimuli. Means for literates and illiterates were 74.17% v 29.71% for bisyllabic and 65.77% v 14.68% for trisyllabic stimuli. This interaction is portrayed in Figure 5.4.E.

Essentially, the presence of this three-way interaction appears to reflect the fact that relative difficulty of trisyllabic stimuli over bisyllabic was more marked in the literates than in the illiterates and more marked in illiterate adults than illiterate children. Conversely, in the literate group Ss were more affected when they were children than when they were adults. Stated another way, whether the reversed word which was given as a stimulus was bisyllabic or trisyllabic determined



Experiment 4 - Fig. 5.4.E: Mean percentage correct responses as a function of age, literacy, length of stimuli (Recognition task)



Experiment 4 - Fig. 5.4.F: Mean percentage correct responses as a function of literacy and type of target syllable (Recognition task) the performance of illiterate adults and literate children, but not as important for the literate adults and illiterate children whose performance did not vary significantly with the type of stimulus (Scheffé, $p < .05$). This may be attributable to a floor effect among the illiterate children and a ceiling effect among the literate adults. An inspection of the distribution of the scores showed this to be a correct interpretation of the result. Illiterate children's scores varied between 0% and 44% with seven Ss (or 19.44%) scoring 0% and only five (or 13.88%) scoring above 30%. In contrast, the literate adults' scores ranged from 66% to 100% with 13 Ss (or 54.16%) scoring above 80% and only five (or 20.83%) scoring below 70%.

1.2.2 Effects of Syllable Type. To assess whether Ss' performance varied with whether stimuli contained open or closed syllables, raw data were subjected to a four-factor analysis of variance whose terms were Age, Literacy, syllable type and group, each with two levels. The analysis was performed first with Ss, then with materials.

	SYLLABLE TYPE			
	Open		Closed	
CHLIT	58.82	(22.87)	57.12	(19.50)
CHILT	13.45	(10.40)	16.70	(18.18)
ADLIT	85.63	(19.84)	76.18	(19.86)
ADILT	24.40	(13.99)	37.76	(22.86)

EXPERIMENT 5 - Table 5.4.3: Mean percentage correct responses as a function of Age, Literacy and Syllable Types. Standard deviations are in parentheses.

The main effect of Syllable Type was not reliable (p>.079). Table 5.4.3 gives the means for each age and literacy group. This outcome was not expected. However, the presence of a Literacy x Syllable Type interaction might clarify this finding. Although only moderately reliable by materials (F_2 (1,32) = 4.73,p <.03) and not significant by Ss, this interaction suggested that while the literates were more successful on stimuli containing open syllables ($\bar{X}$ = 72.22%) than they were on stimuli containing closed syllables ($\bar{X}$ = 66.65%), the illiterates, on the other hand, performed better when a stimulus contained closed syllables ($\bar{X}$ = 27.23%) than when it contained open syllables (18.92%). This outcome is illustrated in Figure 5.4.F.

This interaction was further qualified by a three-way interaction between Syllable Type, Age and Literacy. Although only marginally reliable (F_2 (1,32) = 4.09,p <.052), it indicated that whereas children seemed to be no less able to perform correctly when the stimulus contained an open syllable than when it contained a closed one, ($\bar{X}$ = 58.82% v 57.12%) for the literate children and (13.45% v 16.70% for the illiterate children), the adults' performance on the other hand varied with the Syllable Type with the literates being more successful when the syllables were open than when they were closed, and the literates better on closed than on open syllables.

Having failed to find a main effect of syllable type or any convincing reliable interaction of this effect with age and literacy, another analysis was carried out to investigate the possibility of a Length x Syllable Type interaction. To this end, a four-way ANOVA with

Age, Literacy, Length and Type was performed which failed to yield any significant interactions. Means are displayed in Table 5.4.4.

		SYLLABLE TYPE	
		Open	Closed
LENGTH	Bisyllabic	57.17	49.68
	Trisyllabic	40.96	33.91

EXPERIMENT 5 - Table 5.4.4: Mean percentage correct responses as a function of Length of stimuli (bisyllabic, trisyllabic and Type of Syllable (open, closed).

	LENGTH			
	Bisyllabic		Trisyllabic	
	Open	Closed	Open	Closed
CHLIT	79.07	61.48	50.60	36.1
CHILT	21.28	19.90	10.41	4.1
ADLIT	93.04	74.30	82.65	81.24
ADILT	35.27	43.05	20.16	14.16

EXPERIMENT 5 - Table 5.4.5: Mean percentage correct responses as a function of Age, Literacy, Length of stimuli and Type of Syllable.

Contrary to expectation then, and in contrast with the results from the previous experiments, identification of the target word depended more on whether it was bi- or trisyllabic than on whether it contained an open or closed syllable. In the design of this experiment, it will be recalled, there were 36 stimuli of which 18 were bisyllabic and 18 trisyllabic. On the bisyllabic ones, 12 contained closed syllables and only six contained open syllables. Conversely, of the 18 trisyllabic stimuli, 16 contained open syllables and only two contained closed syllables. It will be remembered also that in contrast with Experiments 2 and 3 which used 'crowded' syllable configurations (eg CCV or CVCC), the present task used only simple CV or CVC configurations. This may also explain the absence of any effect of syllable type.

The results from the REC task indicate that while performance was affected by both age and literacy, the latter was the more important of the two. However, these are overall results and they mask an important finding: the literate children outperformed both groups of illiterates (see Figure 5.4.C). In other words, age seems to be an important factor only when it also correlates with markedly increased literacy.

This conclusion was further substantiated by two other findings. The first one was the presence of an Age x Literacy interaction which indicated that while the literacy effect was more marked in the adult Ss than in the child Ss, the effect of age, on the other hand, was more marked in the literate Ss than in the illiterate Ss. The second finding came from correlation tests on the child data and which disclosed that performance was strongly related to the literacy level and not to chronological age. Furthermore, when only the literate children were considered, no relationship was found to exist between performance and either age or degree of literacy as measured by whether Ss were in first or second grade.

Of the two linguistic variables, namely, the length of the stimuli and the internal structure of the syllable, which were predicted to affect performance, only the former was found to have a significant effect. Thus, target words were more successfully identified when they were bisyllabic than when they were trisyllabic regardless of whether they contained open or closed syllables. This effect, however, was more pronounced in the illiterates than in the literates and more pronounced in illiterate adults than in illiterate children. This was shown to be attributable to a floor effect among the illiterate children and a ceiling effect among the literate adults.

2. PRO Task

2.1 Subject Variables

2.1.1 Scoring and Data. The procedure and method for scoring as well as the statistical analyses were similar to those used in the REC task. It will be recalled that no particular combination of syllables was required for trisyllabic stimuli. That is, Ss could permute into any order they chose. The means and standard deviations for the correct responses for each age and literacy group are displayed in Table 5.4.6 which also shows those for the REC task.

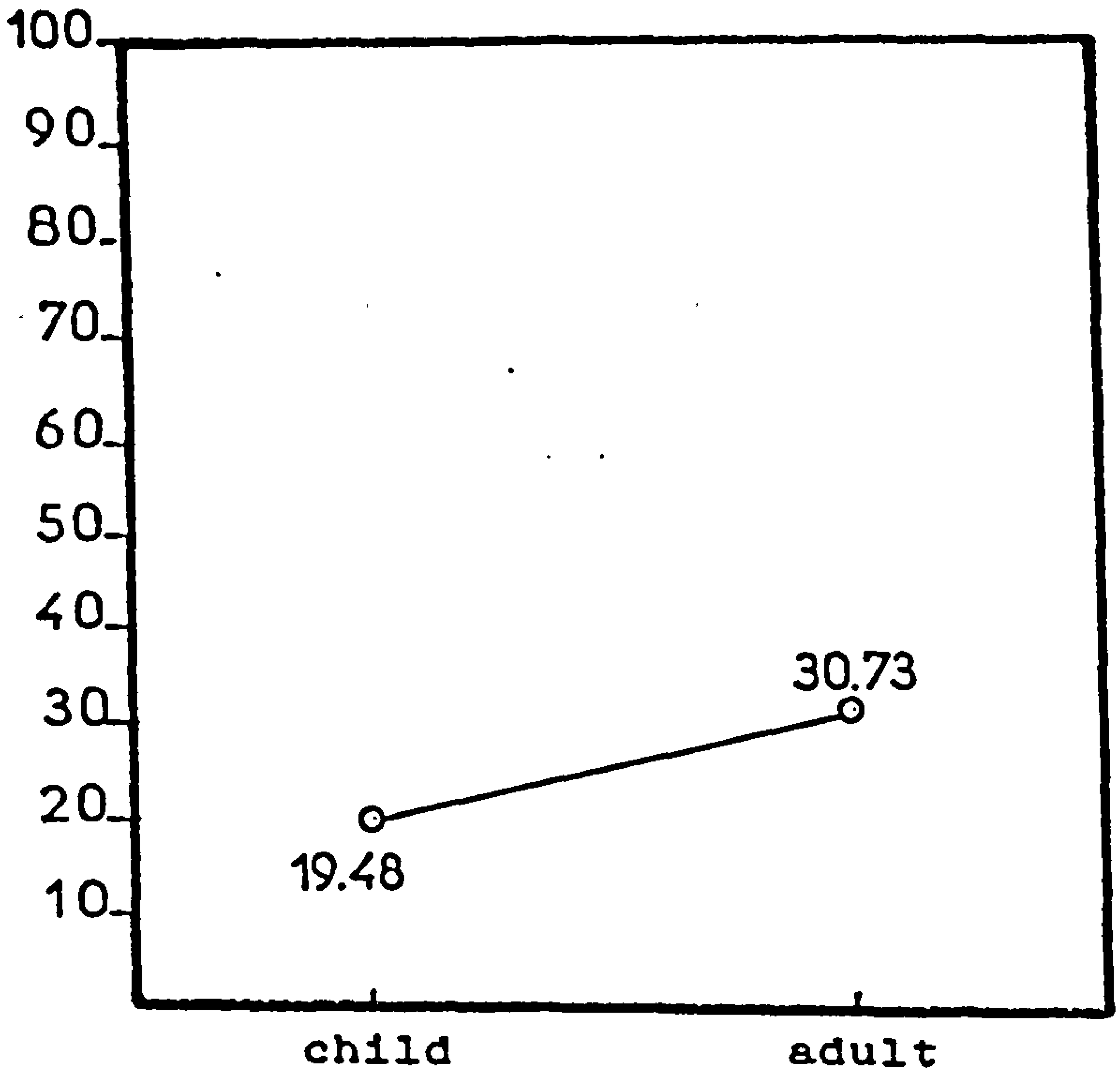
A visual inspection of the data reveals that the pattern of results was not markedly different from either that in the REC task or in Experiment 3. However, it is notable that all Ss performed worse in this task. The task seems generally difficult, but it is more marked in the case of illiterates ($\bar{X}$ = 5%) than in the case of the literates ($\bar{X}$ = 45.21%). It is worth pointing out that 17 illiterate adults (or 77.22%) and 33 illiterate children (or 91.66%) who participated in this task failed to score. It will be recalled that this task employed the same stimuli as the REC task.

	TASK			
	REC		PRO	
CHLIT	58.25	(22.45)	36.03	(21.48)
CHILT	14.96	(14.61)	2.93	(10.48)
ADLIT	81.71	(13.07)	54.39	(24.87)
ADILT	30.13	(26.57)	7.07	(15.15)

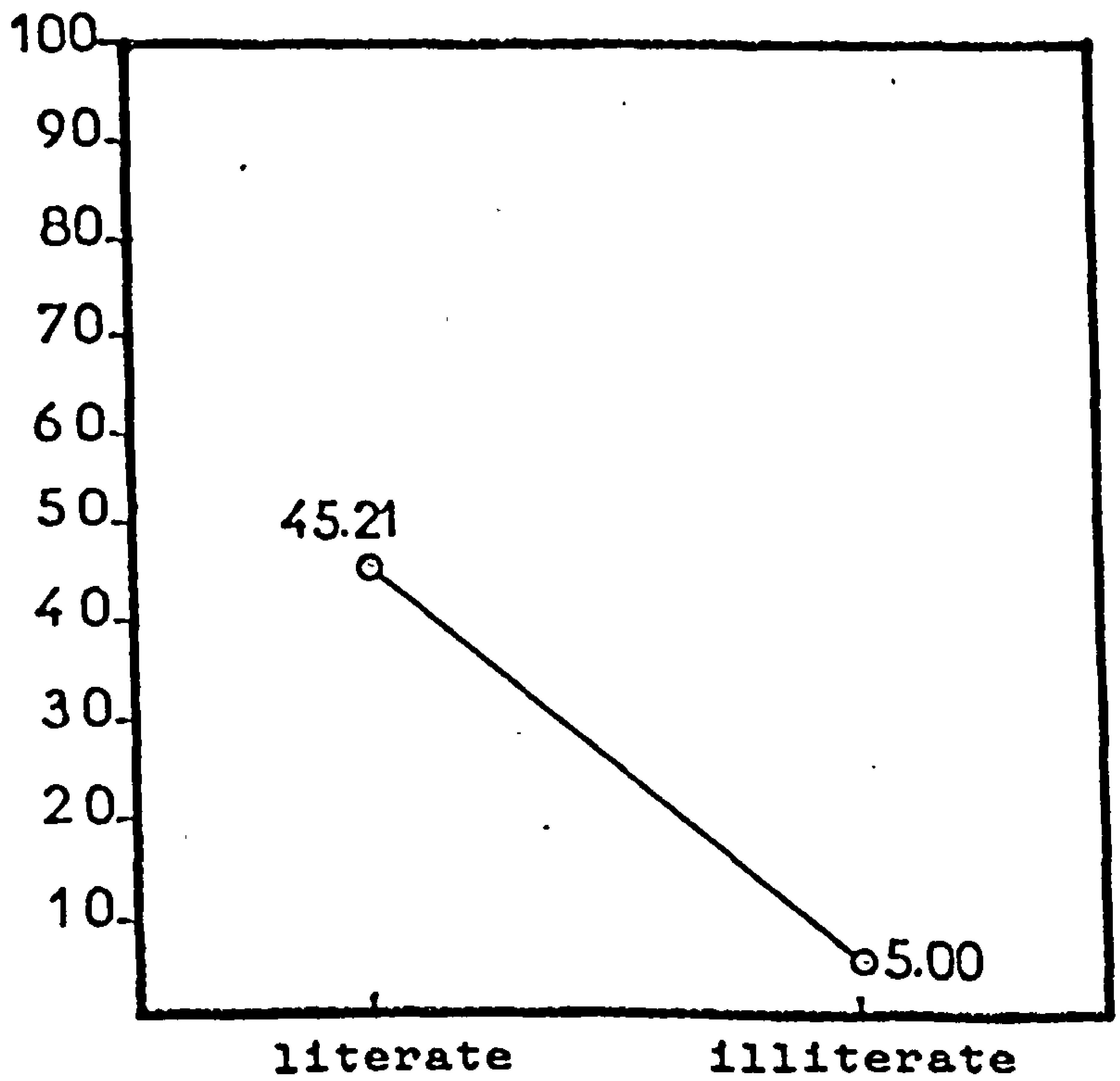
EXPERIMENT 5 - Table 5.4.6: Mean percentage correct responses as a function of Age, Literacy and Task (Recognition, Production). Standard deviations are in parentheses.

2.1.2 Analysis and Findings. ANOVA. Data were subjected to ANOVA's by Ss and by materials to assess the effect of Age and Literacy.

As figures 5.4.G and 5.4.H indicate both Age (F_1 (1,109) = 9.74, $p < .002$; F_2 (1,34) = 63.02, $p < .001$; min F' (1,139) = 8.43) and Literacy (F_1 (1,104) = 124.15, $p < .001$; F_2 (1,34) = 240.45, $p < .001$; min F' (1,135) = 81.93) were reliable with the latter the more impressive.
Means for age and literacy were 19.48% for children v 30.73% for adults and 45.12% for literates v 5% for illiterates.



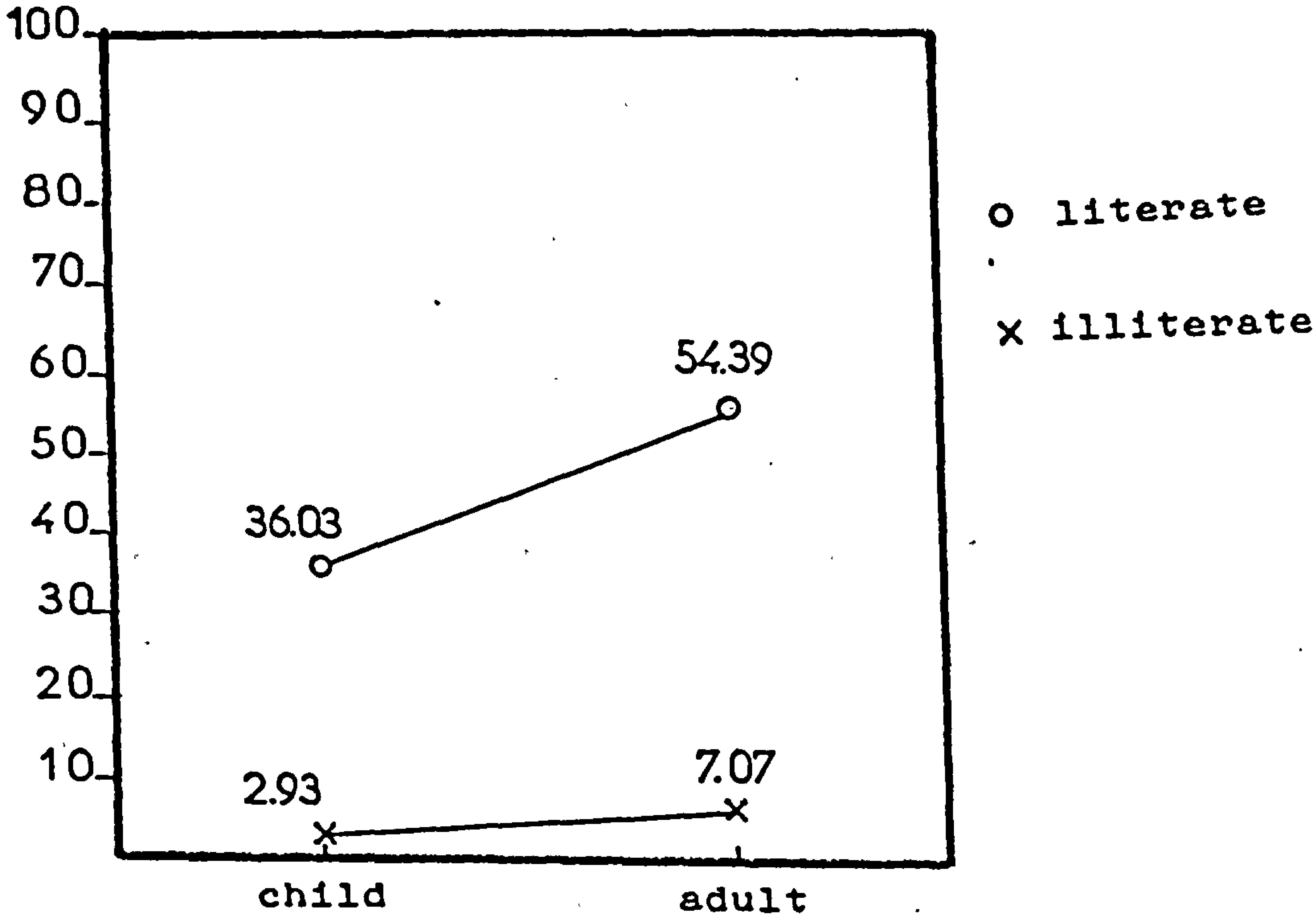
Experiment 4 - Fig. 5.4.G: Mean percentage correct responses as a function of age (Production task)



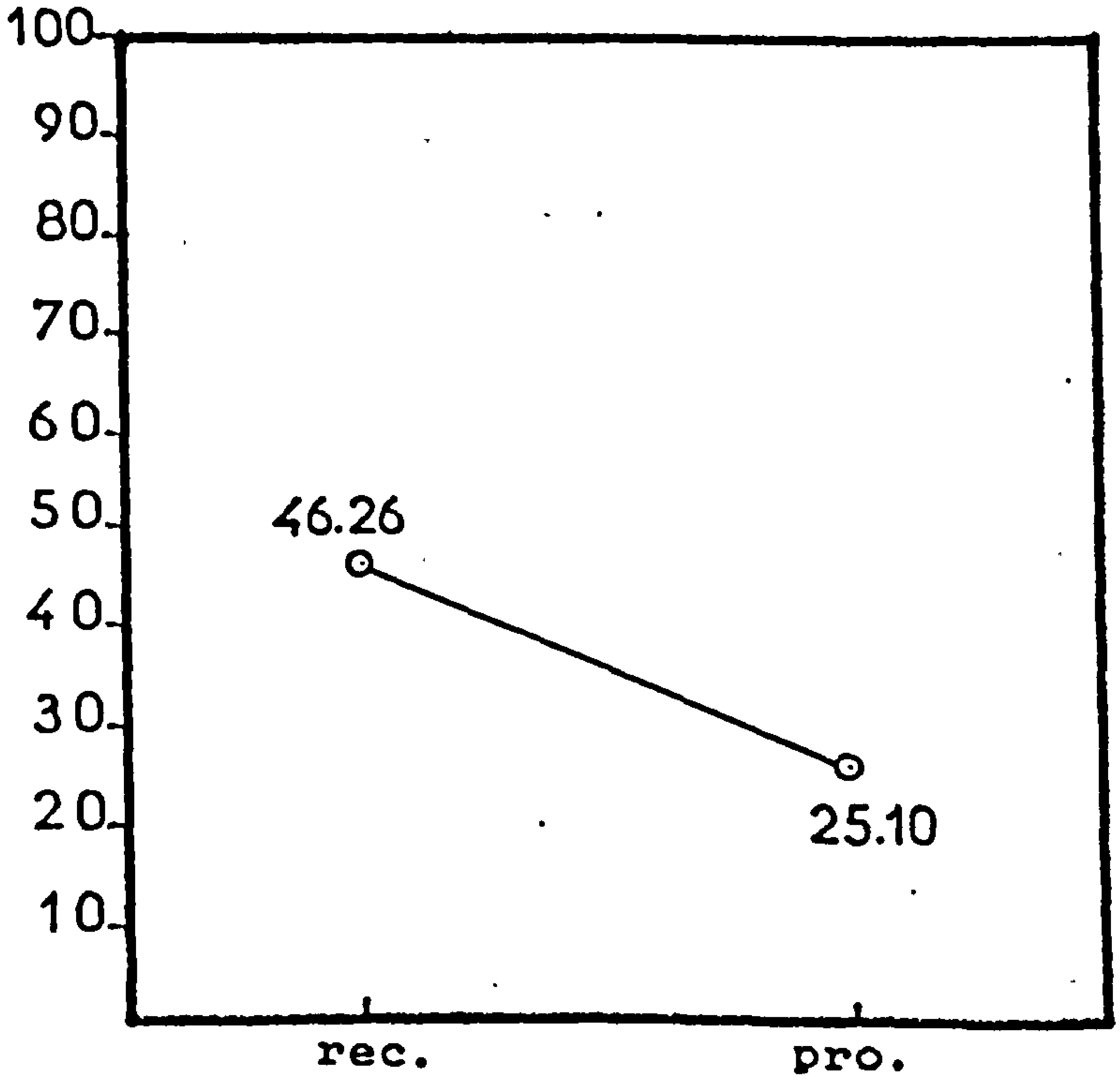
Experiment 4 - Fig. 5.4.H: Mean percentage correct responses as a function of literacy (Production task)

An Age x Literacy interaction was also recorded (F_1 (1,109) = 4.25,p <.04; F_2 (1,34) = 30.10,p <.001) but did not attain a significant min F' (1,133) = 3.73, n.s. This interaction confirms the pattern recorded in the REC task and Experiment 3. That is, whereas the age effect was more marked in the literate Ss, the literacy effect was more pronounced among the older Ss (see Figure 5.4.I). It is worth noting here that scores for the literate Ss ranged from 22.22% to 100% for the adults and 5.55% to 83.33% for the children with 45.83% of the adults scoring above 60% and 28.57% of the children scoring above 50%.

Correlations. Correlation Tests carried out on the child data indicated a strong relationship between literacy level and performance (r= 0.66,p <.01) and a moderate but significant one between age and performance (r = 0.49,p <.01). When, however, either age or literacy was held constant, the correlation dropped to a negligible level (r = Grade x Task . Age = .05 and r = Age x Task . Grade = .09) thus indicating that performance was dependent on both age and level of literacy. This is an important finding because, unlike the previous experiments in which only the level of literacy appeared to correlate with the task score, performance here seemed to increase with advances of both maturity and literacy. This seems to suggest that in addition to specific linguistic awareness of the syllable, certain resequencing or reversal abilities were also required which might necessitate a certain level of intellectual maturity. A closer inspection of the results suggests that a degree of caution should be added to this claim, however. We will return to this point after discussing the correlation



Experiment 4 - Fig. 5.4.I: Mean percentage correct responses as a function of age and literacy (Production task)



Experiment 4 - Fig. 5.4.J: Mean percentage correct responses as a function of task (Recognition vs. production) tests carried out on the literate children's data.

These tests indicated that only a weak relationship was found to exist between either grade and task score (r= 0.21) or age and task score (r = 0.15). When either age or task score was partialled out, even this weak relationship vanished (Grade x Task . Age = 0.12 and r Age x Task . Grade = .07). Means for grade 1 and grade 2 were 30.55% and 40.55%, respectively.

To return to the point discussed above, that performance on this task seemed to correlate with age and literacy, there are two outcomes which are at variance with this suggestion. First, the illiterate adults were not only outperformed by the literate children, but they did not score significantly better than the illiterate children. Second, correlation tests performed on the literate children's data clearly indicate that there was no age effect. Since the age effect was found only when the illiterate children were also considered, it is more likely to have been caused by the fact that the overall mean age for the literate children was slightly higher than that of the illiterates (see Chapter Two), and since the latter performed poorly, this difference came into focus.

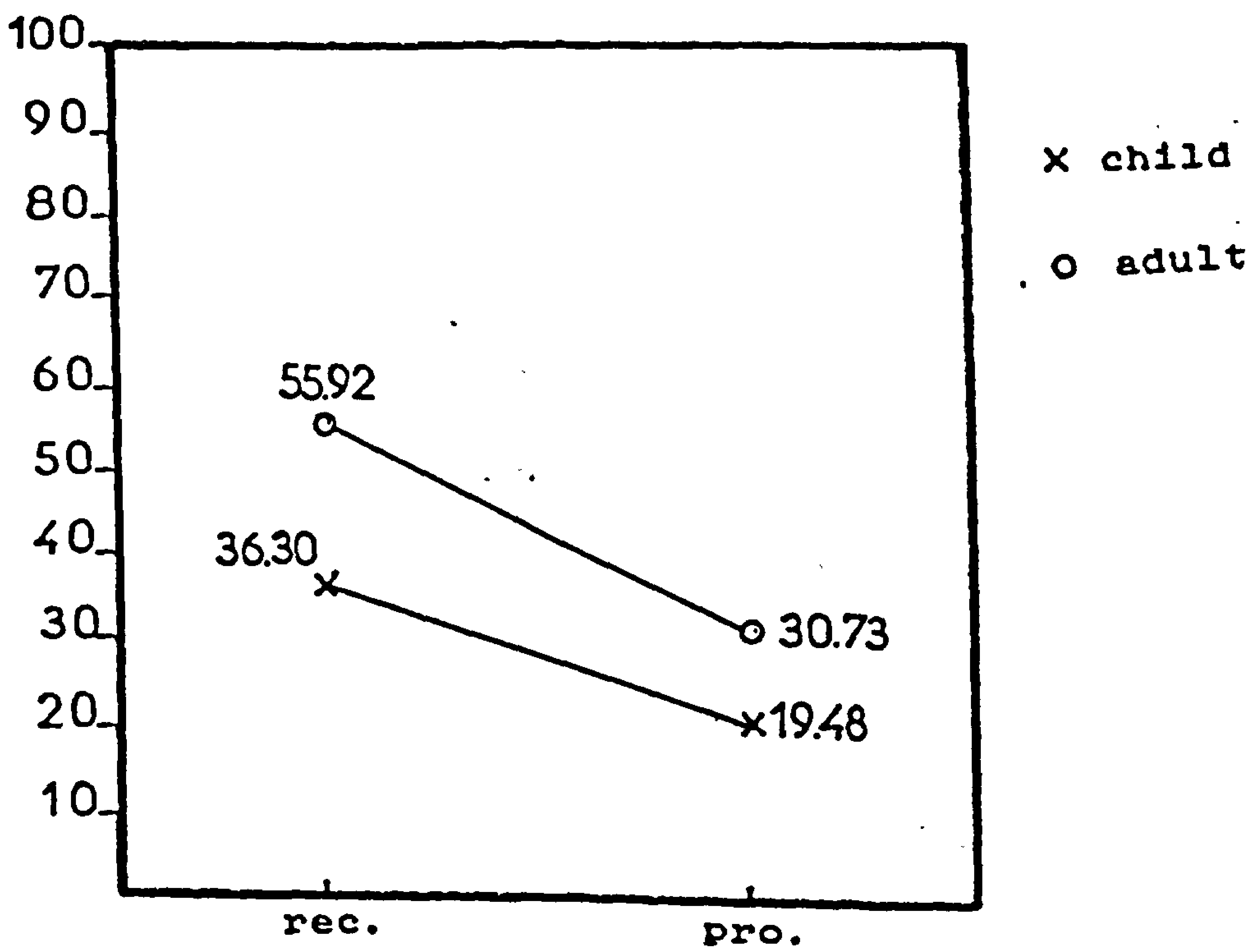
This does not, however, rule out the possibility that the literates may be able to compensate for the absence of one skill by the presence of another. In particular, it would be possible that a literate child with poor "resequencing skills" might make up for this by using "graphological skills".

In summary, the results of the PRO task complement the REC data concerning the difference between literacy and age groups. They indicate that while overall performance was not high in this task, this was more marked in the case of the illiterate Ss who performed very much worse than the literates. Indeed, nowhere in the previous experiments has the effect of literacy been more evident than in this task [19].

3. REC and PRO Tasks Compared

In order to compare the results of the PRO task with those from the REC task, a five-way stimulus-based ANOVA was performed with the stimuli nested in TASK and LENGTH and crossed with AGE, LITERACY and GROUP. Thus, the design was 2(Task (REC, PRO)) x 2(Length (Bisyl, Trisyl)) x 2(Age (CHILD, ADULT)) x 2(Litcy (Lit, Illit)) x 2(GRP (A, B)). The stimuli, it will be recalled were the same for both tasks.

Apart from the effect of Age (F_1 (1,64) = 188.85) and Literacy (F_1 (1,64) = 547.54) which were reliable, the analysis yielded a highly significant effect of Task (F_1 (1,64) = 49.18,p <.001) with better performance on REC ($\bar{X}$ = 46.26%) than on PRO ($\bar{X}$ = 25.10%) (see Figure 5.4.J). The means for each age and literacy group are displayed in 5.4.6. In addition, a significant Age x Task interaction (F_1 (1,64) = 16.13,p <.002) was recorded, but there was no significant LITERACY X TASK interaction (F_1 (1,64) = 3.96, n.s) or AGE X LITERACY X TASK (F_1 (1,64) = 0.87, n.s).



Experiment 4 - Fig. 5.4.K: Mean percentage correct responses as a function of age and task

The presence of the Age x Task interaction suggests that the difference between children and adults was greater in the REC task (36.30% for the children v 55.92% for the adults) than in the PRO task ($\bar{X}$ = 19.48% v 30.73%). Figure 5.4.K illustrates this result.

While the length was also reliable (F_1 (1,64) = 9.16,p <.003), there was no interaction between this effect and task, an indication that, regardless of the type of task, performance was better when the stimuli were bisyllabic than when they were trisyllabic.

Taken together, these results confirm the observations made earlier that overall, Ss were by far more successful in the REC task than they were in the PRO task. In language acquisition and learning studies, recognition and production methods are usually distinguished in terms of degree of difficulty. Our findings have confirmed this. The two procedures seem to have tapped different aspects of the Ss' metalinguistic knowledge and both have unequivocally distinguished literates and illiterates. But the main feature of these two tasks is that they elicited the role of script in general and orthographic knowledge in particular. We have had occasion to discuss this issue under Experiment 2, but a qualitative analysis of the data showed that it reached a peak here. It is to these qualitative aspects of the the responses that we now turn.

An examination of the response pattern revealed that the literate Ss were not guided solely or even mainly by the auditory information contained in the input. Rather, they appeared to have access to a larger store of knowledge mainly including orthography which they were able to bring to bear on the problem at hand. Thus, Ss did not always reverse words in a manner dependent upon their phonology. When they could not quite figure out the target word, they relied on a second strategy, the written word as a mediator to help them separate sounds. Erroneous responses were often contaminated by orthography. Words were given as if spelled backward, not as a reversal of sequence of spoken units.

Unlike the previous experiments where it was mostly literate children's responses which showed contamination of knowledge of reading, in the PRO task this emerged in both literate age groups, though it was more evident in the younger. Responses revealed that Ss will often insert elements present in the orthographic strucutre of the word that are not in the phonological structure. For example, the feminine gender marker /t/ (eg /quqa(t)/'artichoke') which is present orthographically, but not phonetically in the word's pausal form, was given as a part of the reversed word. In general, when substantial phonemic information is missing in the 'spelling' of the word, mental representation proceeds with an enhanced use of orthographic codes.

These outcomes clearly suggest that the literate Ss recode the input visually and, mentally scan the graphic representation [20].

The qualitative analyses of the data also revealed that overall Ss evidenced better identification of the target word in the REC task when the reversed input word retained the original vowel pattern (or stem vocalism) of the target. For example, Ss had most difficulty with reversed words like /naziku/ (35.09%) and /radimu/ (10.41%) as input which does not retain the sequence of vowels of the original word (ie /kuzina/ and /mudira/, respectively) than with the input /zadixa/ (65.27%) which does (xadiza).

Now, vocalism (or vowel melody) [21] is an important morphological feature in Arabic and does not include all vowel sequences (ie is not freely distributed among vowels). If the vowel melody is lost in a stimulus, then, there is a breakdown in performance. When faced with items which do not retain the vocalism of the original word, literates tend to resort to their knowledge of orthography to recover the target word. The strategy was only sometimes successful.

It follows from this, that conscious access to the target word in a resequencing task may depend upon consciously available orthography when the phonological organisation is suppressed (ie breaks down). Orthography seems to help Ss organise their phonological knowledge. In particular, since reversed words have no lexical representation, performance seems to break down rapidly and, for performance to be successful, these words must be maintained through a nonlexical phonological representation. Here, literacy is facilitative. It provides a representation for the disrupted word. Orthography seems to have a mnemonic value because spelling helps preserve the input word in memory while Ss operate on it.

Illiterates, on the other hand, may be more attuned to the meanings of the words than to their structural characteristics, and since they have no code to aid them maintain the disrupted word, their performance seems to break down. They may also have a further problem. Since the reversed syllables are not always identical with the acoustical units of the target word, the target word cannot be identified only by hearing. Unless Ss are aware of the fact that syllables or syllabic-like conceptual units are only imprecise and abstract anologues of the way these units sound in the word, the task is a difficult one. That the literates did it, is an indication that metalinguistic processing was not only constructed on acoustic basis, but involved another level of analysis with the aid of literacy. That is, the problem is at the level of accessing mental representation constructed by the perceptual system rather than at the level of auditory analysis.

We conclude that conscious access to the target word in a resequencing task may depend upon consciously available orthography which seems to aid literate Ss to stabilize their phonological knowledge.

VI General Summary

The experiments reported on in this chapter have asked some direct questions pertaining to the ways in which metalinguistic knowledge is deployed in the process of attending to, identifying and manipulating the syllable as a unit of speech. With the main purpose of the study in mind, the experiments were designed to determine the factors within

Ss which affect their performance and to establish the basis on which they perform the various tasks. It also asked about the linguistic variables within stimuli which were predicted to have an effect on performance. Typically, the variables manipulated in these experiments were Age, Literacy, Length of stimuli, internal syllabic structure of stimuli, stress and adjacent context.

The aim of this section is to review the major findings related to the relevant variables which have been generated by quantitative and qualitative analyses. In experiment 2 which investigated the ability to identify initial syllables, Ss of all age and literacy level generally performed quite well, with the task relatively unaffected by such variables as Age or Literacy or such linguistic variables as Length, although Ss were found to perform better when targets were open syllables than when they were closed. Ss' ability to identify initial syllables gave rise to the question of the basis on which they were responding. One hypothesis was that Ss might be using position as a basis for their responses. Experiment 3 tested this hypothesis.

Using the same paradigm and the same stimuli as in Experiment 2, Experiment 3 required Ss to identify the final syllable. The results from this experiment confirmed the hypothesis, but there was an interaction between Task and Literacy. The two literacy groups differed drastically in this experiment in which the illiterates were impaired by the position effect. Experiment 3 employed the same Ss and the same items as Experiment 2.

Experiment 4 examined Ss' ability to manipulate syllables by rearranging their order in a sequence. Two tasks were employed: One (Recognition Task) required Ss to identify a meaningful word the first and last syllable of which had been interchanged, while the other (Production Task) required Ss to alter the normal sequencing of a real word by scrambling its syllables. Overall, it was easier for Ss to recognise a target item than to produce one. In both tasks, the literates by far outperformed the illiterates.

FOOTNOTES

1. A recent study by Younes (1984), however, argues that emphasis in Palestinian Arabic should be treated as a property of the consonant, not the syllable.

2. This paradigm is based on the assumption that increased sucking rate serves as an index to the infant's orienting response to a novel stimulus.

3. The Japanese writing system has three different types of scripts, namely, Kanji, Katakana, and Hiragana (four if we also count the Roman letters used in many Japanese texts, ie romaji). Kanji is logographic, Kana is syllabic used for content words, while Hiragana, also syllabic, is used for grammatical formatives.

4. The cohort type model was developed to account for lexical access in speech perception. In this model the initial few phonemes of an input word activate a cohort set in the lexicon. The cohort set contains a representation for every word that begins with the intial phonemes that have been heard. As more of the stimulus word is heard, the size of the cohort set is progressively reduced until only a word candidate remains, at which point the word is recognised. For many words, recognition occurs before the entire word is heard.

5. Stress is defined here as prominence, including natural changes in pitch, duration and volume.

6. No reliable source of word frequency in Moroccan Arabic is available.

7. The issue of stress in Moroccan Arabic is not settled yet. There has been little work on the organisation of stress system in this language.

8. The most frequent onset structure is a cluster of two consonants. Onset structures of three-consonant clusters arise only in two cases. The first is when onset has the structure /st C -/ (where C stands for any consonant, and the second case is when the onset has the structure /Ci Ci C -/ (where Ci Ci stands for initial geminate and C for a consonant). The maximum coda, on the other hand, is two consonants.

9. Ambisyllabicity involves the sharing of internuclear consonants by two syllables adjacent to one another. Ambisyllabicity, in its strictest sense assigns a consonant to both syllables.

10. It is worth noting here that Rozin and Fox claim that their procedure "would have a fewer extraneous cognitive requirements than any of the previous studies". (p 353)

11. Syllabic breaks for all stimuli were substantiated by reference to, among others, Al-Ani and May (1978), Al Mozaini (1981), McCarthy (1978) which deal with general rules of syllabification in Arabic, and to Benhallam (1980) and Sayed (1980) which specifically investigated the syllable in Moroccan Arabic.

12. As we note in Footnote 7 above, the issue of stress in Moroccan Arabic is not settled yet. Until such time as more research is available, we can do no more than note that stress is not important in the process of becoming aware of the initial syllable.

13. These are the pausal forms for /ħama:matun/ and /baqaratun/ (both in nominative forms). Pausal form is a grammatical term perculiar to Arabic. It indicates the omission of the final inflectional endings.

14. Of the 120 Ss, only 118 participated in this experiment. Two literate children were unavailable.

15. This distribution could not be accounted for in the design since it is extremely difficult to systematically vary middle syllables.

16. Task order was (i) initial syllable identification, (ii) initial segment identification and (iii) final syllable identification.

17. We can make a distinction here between language (or verbal) games and verbal play, in that the former, but not the latter, are characterized by the presence of rules which make them transmittable from one player to another (ie conscious). In that sense, they are metalinguistic activities. Verbal play, however, is spontaneous. It can be seen as a function to develop mastery over language during acquisition.

18. Of the 120 Ss, only 117 participated. Two illiterate adults were unavailable, and one literate child (Grade 2, group B) was accidently assigned the wrong set of stimuli.

19. It is worth pointing out here that for illiterate Ss who were unable to give a correct response, E presented the input stimulus a second time, but syllabified (eg input ra.mi.sa). Even this, failed to facilitate performance.

20. A recent report by Cowan and Leavitt (1980) provides similar findings. The authors report the case of two children (aged, eight; ten and nine; eleven) who "talk backward" whose reversals showed orthographic contamination. Examples cited include 'nine' reversed / nin/; 'guy' as /jag/; 'box' as 'ksob'; 'Mars' as /sram/; 'men's' as /snem/; 'trash' as /həsart/.

    Jenkins (reported in Kavanagh and Mattingly (1972), p 157) describes an experiment in teaching Pig Latin to naive undergraduates in which some Ss removed the first letter of a digraph which represented a single sound (eg haircay for 'chair').

21. Unlike the more familiar basically concatenative morphology of the Indo-European languages, Arabic morphology is pervaded by a wide variety of purely morphological alternation internal to the stem. The basic of Arabic morphology is a set of prosodic templates that vowel and consonant melodies are mapped onto by certain rules of great generality. Suffice it to note here that certain verbal categories such as aspect and voice are marked by altering the quality of the vowels of the system in a systematic way. A fuller treatment of the nature of this systematic variation in vowel quality can be found in McCarthy (1979, 1981). Also, see Chapter 5 of the present study.

CHAPTER FIVE

I. Introduction

The aim of this chapter is to extend our knowledge of meta-linguistic awareness by considering one further aspect of phonological awareness, namely, the extent to which literate and illiterate children and adults can demonstrate their ability to deliberately focus on and manipulate speech segments.

The three experiments which make up this chapter were specifically designed and carried out to:

1) determine the ability of Ss to identify speech segments in word-initial position (Experiment 5) and in word-final position (Experiment 6), as well as the ability to manipulate segments by re-arranging their order in a sequence (Experiment 7).

2) assess the linguistic factors which might have an effect on Ss' performance on the various tasks. Typically, the test materials employed in these experiments were selected to vary the following linguistic factors: (i) the length of the stimulus words in terms of the number of segments which comprise each one of them; (ii) the type of target segments involved (eg whether a target is a consonant or a vowel an obstruent or a sonorant); (iii) the adjacent context (whether a target segment is part of a consonant cluster (CC configuration) or part

of a CV configuration).
3) test directly the hypothesis that knowledge of the orthographic structure of the language is used as part of the judgment strategy, and that, therefore, knowledge of a particular writing system alters our intuitions about segments.

The chapter is structured in the following way: First, we examine the status of the speech segment in a general theory of language structure and in linguistic behaviour. Then, each one of the experiments is described, analysed, and discussed separately. Finally, the major conclusions that have been drawn from each experiment are discussed and the implications considered.

II. The Status of the Segment

Though the first comprehensive phonemic theory has been developed only since approximately the turn of the century (Kramsky, 1974; Jones, 1957), there had been an assumption by language researchers ever since the emergence of alphabetic writing systems that the sound system of a natural language is structured in terms of individual segments [1].

From the point of view of traditional linguistic theory, the phoneme has proved to be indispensable for the kind of things a grammarian deals with, notably, stating grammatically-based phonological regularities. The use of the segment rather than, for example, the syllable or the word, seems to provide principled means of capturing significant linguistic phenomena. Many phonological rules only receive appropriate formulations in terms of the segment [2].

In (orthodox) generative phonology (eg Chomsky, 1964; Chomsky and Halle, 1968) the phoneme has been shown not to correspond to any level in the derivational process of words from abstract representations to surface forms. This is one reason why generative phonologists argue that an "autonomous phonemic level" does not in fact exist and, as a consequence, the phoneme becomes a useless concept in generative phonology.

It is not clear, however, that the definition of the phoneme that Chomsky and Halle argue against is one which most structuralists would recognise as their own. (The same point has also been argued by, among others, Derwing (1973, p 168-188), Hutchinson (1972) and Linell (1979)). A generative phonologist, Schane (1971), decides otherwise: To him, to the extent that it is a necessary tool for explaining certain features of surface sound patternings and historical changes, the phoneme does have a place in generative phonology, after all [3].

Historical language changes have also been used as an argument for considering the phoneme or segment as an appropriate unit in linguistic theory. Innumerable well-attested changes affect segments or natural classes of speech sounds. Grimm's law is a prime example of such a change. In this case, the correspondence between Proto-Indo- European (PIE) and Germanic (G) can be charecterized in terms of feature changes in particular classes. Thus, PIE unvoiced plosives are realised as unvoiced spirants, voiced plosives as unvoiced plosives and voiced aspirates as voiced fricatives. However, as Ohala (1983) observes, certain facts would suggest caution before concluding that the phoneme is the appropriate unit for all speech related tasks. Most historical changes, Ohala argues, seem to be 'conditioned changes', that is, they occur in specific phonological environments. Certain sounds changed only in certain positions. For example, PIE [p], [t], [k], changed to voiceless fricatives in the Germanic languages primarily only in word initial position. The same sounds after [s] did not change. Furthermore, in medial position, the very sounds often became voiced, not voiceless fricatives (eg Latin 'pater' --> English 'father' with [ð] not with [θ]). Again, according to Ohala, if the phoneme were the crucial unit in sound change (and thus language use), these sounds would have undergone the same change in any and all contexts they appear in.

Psycholinguistic research also reveals that the status of the segment is controversial. In speech perception, a long-standing issue has been the choice of a minimal unit of perceptual analysis. The bulk of research over the last thirty years has been concerned principally, if not almost exclusively, with syllable, phoneme and feature perception. Conclusions, however, have been contradictory and, at best, inconclusive (see chapter 4). For example, while Warren (1976) suggests that "phonemes ... are without perceptual basis ... and have no direct relevance to perceptual processes leading to the comprehension of speech" (p 409), Foss and Swinney (1973) and McNeill and Lindig (1973) conclude that the primary unit of speech perception is whatever unit the hearer is paying attention to. For these researchers, the unit of speech perception can be phones, phonemes, syllables, words, phrases, or clauses depending on the nature of the listening task. Recently, Barry (1983) carried out a series of experiments designed to approach the question of processing units at segment, syllable and foot level. To this end, he used a click-placement task as developed by Ladefoged and Broadbent (1960) and later by Fodor and Bever (1965). Clicks were placed in the measured centre of the consonant and vowel of the first syllable of the foot in an utterance.

Ss were required to mark on a prepared answer sheet the segment in which a click was located. Barry interprets his findings as indicating that (i) segments are not units of perceptual processing (placement scores were at essentially chance level) and (ii) the syllable is a strong candidate for the basic processing unit.

Finally, although they feel that the reality of the phoneme is not based on perception of articulation, Savin and Bever (1970) and Bever (1977) claim that it is impossible to do without phonemes in psychological theory of language, but for non-sensory and non-articulatory reasons (1977, p 81). Bever seems to summarize his position by claiming that "phonemes are behaviourally abstract" (p 82 emphasis in text).

Studies of speech perception in early infancy have shown that infants as young as one month can discriminate between small differences in syllabic features by showing categorical perception of the voiced-voiceless distinction (eg Eimas et al 1975; Eimas, 1975; Morse, 1979). Thus, presented with the sounds [ba] and [pa], infants seem to be able to discriminate between these two syllables which involve differences in the onset time of the initial consonant sound. It is, however, unclear just how we are to interpret this finding, since as Kuhl and Miller's (1975) study revealed the same sharply categorical perception of voice distinction also occurs when listeners are chinchillas.

Schvachkin (1973) examined the ability of one-year-old infants to make various types of phonemic distinctions. One of the observations he made was that contrasts were discriminable in the syllable-initial position of utterances. Schvachkin advanced the hypothesis that in producing their first words, young children seem to be following a principle much like this: 'Get the first segment right, so it will be easier for the listener to work out which word is being said.' However, and as Garnica (1973) observed, Schvachkin's task was considerably more complex than present-day measures and hence difficult to assess [4].

More recently, Eilers <u>et al</u> (1977) studied the perception of a variety of fricative contrasts, some of which involved place-of-articulation differences (eg [sa] / [ʃa] and [fa] / [θa]). Using the head-turning paradigm with 6- and 12-month-old infants, they found that while both age groups discriminated the [sa] / [ʃa] pair, neither age group showed evidence of discriminating the [fa] / [θa] pair and only the 12-month-olds discriminated the [fi] / [θi] pair.

In speech reproduction, some linguistic analyses of speech errors have demonstrated that certain types of errors occur in which single segments are anticipated, transposed, added, or deleted. These errors seem to point to the discreteness of such phonological units in both normal (eg Fromkin, 1973, 1980; Fry, 1973; Stemberger, 1983) and aphasic speech (eg Blumstein, 1973).

Fry discusses the implications of such errors for grammatical theory and draws the conclusion that the occurrence of such phonemic errors, mainly those that involve anticipation or preservation of a phonological feature, makes it impossible to accept the hypothesis which has sometimes been advanced that language users do not operate with segments and that the syllable or the word must be regarded as the smallest functional unit for speakers and listeners.

Boomer and Laver (1968), also examining speech errors, do not seem to agree with the above interpretation. They note that "that we perceive the result (ie of a speech error) as involving segments, rather than as involving properties of syllables, for instance, may be attributable to a perceptual 'set' given to us, as listeners, <u>by our alphabetic culture</u>, and, as linguists, by a phonemic approach to phonological analysis" (p 9, emphasis mine). In fact, we contend, this is precisely what should be expected, given that it is quite implausible that a speaker's linguistic perception will remain unaffected by his becoming literate. We shall have occasion to return to Boomer and Laver's perceptive remark at the end of this chapter when we examine the relationship between awareness of segments and knowledge of a writing system.

Another, perhaps more notable, observation which is usually invoked in support of the 'existence' of segments, is the occurrence of the supposedly superior alphabetic writing system. This is an important issue which is directly related to the underlying aim of the present study. However, we defer consideration of it until the end of this chapter when we investigate the relationship between the emergence of the alphabet and linguistic awareness. It is sufficient to note at this point that certain facts would suggest caution before concluding that the concept of the phoneme underlies alphabetic writing systems. In fact, we shall argue that the emergence of the alphabetic writing system was a historical accident rather than a conscious insight.

The evidence reviewed to this point demonstrates that although it has been accepted as one of the most basic notions in linguistic theory, the speech segment (phoneme) is also one of the most controversial as its 'existence' or 'reality' continues to be a debatable issue both in studies of linguistic theory and linguistic behaviour.

III Experiment 5

A. Method

1. Materials and Design

Thirty six experimental words of varying length (mostly mono- and bisyllabic) and syllable structure were selected such that there were two sets (A and B) each containing 18 stimuli. Half the Ss in each sample received one set, and the other half the second set. The test stimuli were randomised with respect to the type of initial segment each contained (see below) with Ss encountering the same random order within each set. A complete list of the test stimuli is to be found in Appendix D.

To gain an appreciation of the factors that might affect the Ss' ability to attend selectively to the initial segment, the materials were varied systematically according to the following design:

(i) Each target segment was represented twice in the list, once followed by a consonant (eg ktab) and once followed by a vowel (eg kura). In approximately half the stimuli (8 in set A and 9 in set B) the initial segment was a part of a cluster of two consonants (ie part of a CC- configuration) and in the other half (10 in set A and 9 in set B) it was a singleton (ie part of a CV configuration). This design was based on the assumption that decisions on the initial segment would not be made independently of the following context. In particular, because the onset-rhyme [5] hypothesis predicts a looser connection between the initial C and V of a CVC configuration where the boundary between the onset and the rhyme is located, it was expected that performance would vary with whether the target segment was followed by another consonant or by a vowel. Some behavioural evidence - at least for English - is available which suggests that clusters are represented as a cohesive unit [5] (Hockett, 1967; Mackay, 1972, 1978; Klatt, 1980; Shattuk-Hufnagel, 1979; and more particularly Treiman, 1980, 1981, 1982 and Treiman et al, 1982).

On the basis of both speech errors and patterns of change in Pig Latin (where speakers change words such as "street" to "eet-stray"), Hockett (1967) for example, proposes that a level of linguistic analysis of initial consonant sequence followed by the rest of the word (eg pr+oblem for problem) should be considered. Mackay (1972, 1978) also made a similar suggestion. Analysing speech errors, he found that "breaks" in word blend errors [7] often occurred between syllables. When, however, they occurred within syllables, consonant clusters remained intact more often than would be expected by chance: 6% of the breaks occurred within consonant clusters as compared to 94% which occurred outside. Word-blend errors were also examined by Klatt (1980) and Shattuck-Hufnagel (1979) for evidence to support the onset-rhyme hypothesis. Klatt asked whether errors tend to break the CV connection more often than the VC connection. In a sample of 100 word-blend errors (based on the 1978 MIT corpus which contains 6,000 errors) that have been analysed, 22 involved clear C/V breaks. Because of shared segments between the two blended words, 56% were ambiguous. Klatt concludes that there is a weak tendency for breaks to occur between onset and rhyme. Shattuck-Hufnagel's analysis of the MIT-Cornell University corpus was obscured by the number of cases that blend at a shared phoneme (eg prubble for problem + trouble) making it impossible to determine whether the blended portions correspond to the initial consonant sequence and the rest of the word or not.

Further indications that clusters may function as cohesive units come from experimental research involving either the perception and identification of speech sounds (Treiman et al, 1982) or manipulation of nonsense syllables in various ways (Treiman, 1980, 1981, 1983). Using error rate, Treiman found that it was more difficult for 5-year-old children to identify an initial consonant when it occurred as the first element of a cluster (eg SNA) than when it was a singleton (eg Sa or san). Similar results were also obtained with adults. Using reaction time rather than error rate as the dependent variable, Treiman et al (1982) found that Ss took longer to detect syllable-initial consonants when these consonants were part of a cluster (eg sna). Treiman's interpretation of these findings is that the initial consonant that is part of a consonant cluster is at a 'deeper level in the tree' (ie farther from the top) than a consonant that is not. Thus, /sna/ consists of the onset [sn] and the rhyme [a]. The onset is in turn subdivided into [s] plus [n]. According to Treiman, [s] is at a depth of two in [sna]. In [san] which contains the same phonemes but in different sequence, [s] is at a depth of one.

In view of this, we predict that context (ie whether initial segment is followed by a consonant or a vowel) will have an effect on Ss' performance.

(ii) The materials were also varied systematically according to whether the target segment was an obstruent or a sonorant. Obstruents included plosives and fricatives, whereas sonorants included glides, liquids and nasals (see Table 6.5.1 below).

CONTEXT	TYPE OF INITIAL SEGMENT			
	Plosive	Fricative	Sonorant	
C + V	7	8	4	19
C + V	5	8	4	17
	12	16	8	36

EXPERIMENT 5 - Table 6.5.1: The distribution of stimuli as function of type of initial segment (plosives, fricatives, sonorants) and type of context (ie whether initial segment is followed by a consonant or a vowel) [8].

The rationale for this design was based on both theoretical and behavioural evidence. First, according to phonological hierarchy (or sonority hierarchy, (Bloomfield, 1933; Venneman, 1972; Hooper 1976; Zwicky, 1976; Price 1980) gradation of sonority exists among consonants. This view holds that individual consonants possess a preferred distance or affinity to the sonority peak of the vowel, with liquids, glides and nasals having greater vowel adherence than fricatives, which have greater adherence than plosives.

Second, findings from some experimental tasks suggest that continuants are easier to identify than plosives (Zhurova, 1973; March and Mineo, 1977) and postvocalic liquids (eg /l/ and /r/) are more closely associated with the vowel than the other postvocalic consonants (Mackay, 1978; Stemberger, 1983).

Based on this, we predict that if sonorants are more cohesive with vowels than obstruents, then Ss will be less able to isolate the former in identification of the word-initial segment.

2. Procedure

The procedure employed in this experiment was similar in structure to the one in Experiment 2 (Initial syllable identification). They differed only in the nature of the target. In the present experiment the knock-knock game was modified such that Ss were required to identify the initial consonant of a word [9].

B. Results and Discussion

1. Subject Variables

1.1 Scoring and Data

A response was scored when the initial segment was identified correctly.

The relevant data representing the mean percentages of correct responses and standard deviations for each age and literacy group are displayed in Table 6.5.2 below.

		LITERACY			
		Literate		Illiterate	
AGE	Child	71.44	(16.49)	26.61	(12.94)
	Adult	78.69	(16.71)	31.93	(15.81)

EXPERIMENT 5 - Table 6.5.2: Mean percentage of correct responses as a function of age and literacy. Standard deviations are in parentheses.

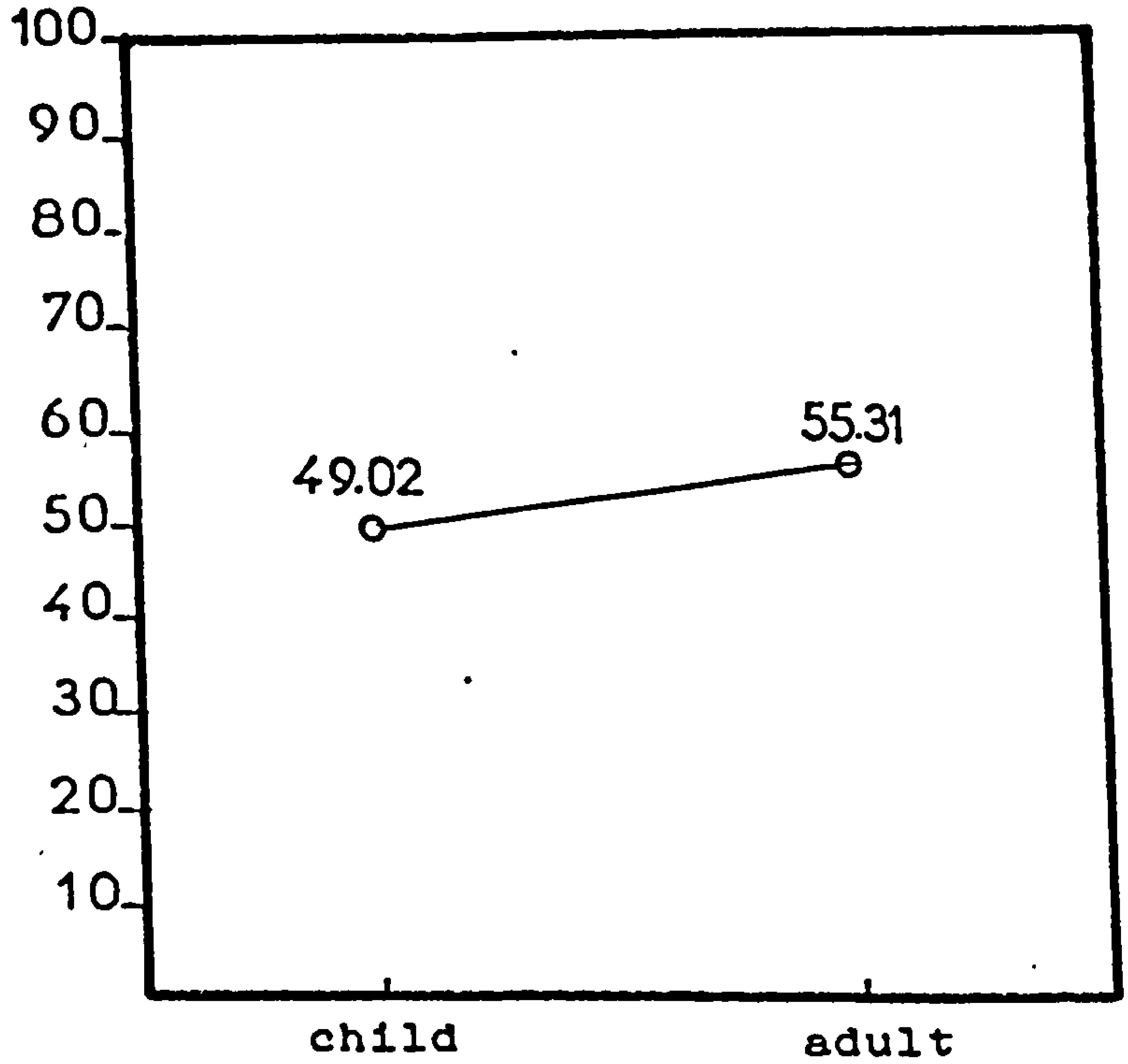
1.2 Analysis and Findings

As in the experiments reported in the previous chapters this experiment and the two subsequent ones employed two statistical methods, namely analyses of variance and Pearson Product Moment Correlations. The ANOVAS were performed on all Ss and materials, whereas correlation tests were performed on the child data only.

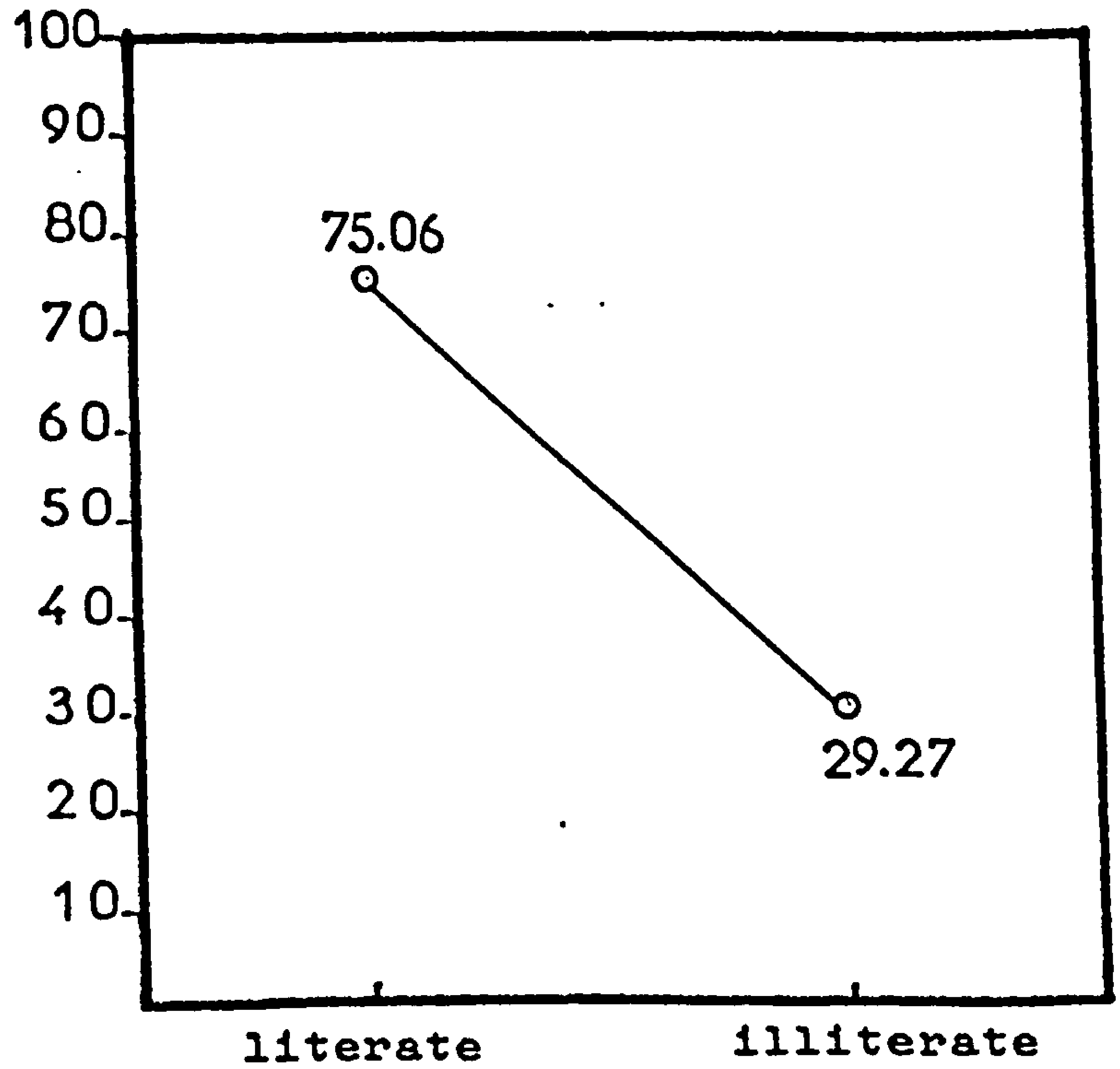
1.2.1 ANOVA

Raw scores were submitted to two separate (one by-subject and one by-stimuli) three-way ANOVAS with Age, Literacy and Group (each with two levels) as the independent variables.

As displayed in Figure 6.5.A., the main effect of Age was



Experiment 5 - Fig. 6.5.A: Mean percentage correct responses as a function of age



Experiment 5 - Fig. 6.5.B: Mean percentage correct responses as a function of literacy

significant both by Ss (F_1 (1,112) = 4.54,p <.003) and by materials (F_2 (1,34) = 20.23,p <.01) with significant min F' (1,144) = 3.70,p <.05. Means for the child and adult Ss were 49.02% and 55.31%, respectively.

The effect of Literacy was the more impressive of the two variables indicating that it accounted for much of the variance both across Ss (F_1 (1,112) = 248.42,p <.0001) and across stimuli (F_2 (1,34) = 152.72, p <.0001) with very highly signficant min F' (1,79) = 94.58,p <.01). Means were 75.06% and 29.27% for literate and illiterate Ss, respectively. This result is displayed graphically in Figure 6.5.B.

The interaction between the effect of Age and Literacy was not found to be reliable (F_1 (1,112) = 0.14) and (F_2 (1,34) = 0.22).

1.2.2 Correlation Tests

First order correlation test were employed to determine the three-way relationship between the children's chronological age, level of literacy and performance on the initial segment identification task. The aims and procedures were similar to those of the previous experiment and will not be discussed further.

These tests revealed a high degree of association between the children's literacy (Grade) level and the task score (r = 0.61), t = (1,70) = 6.44,p <.01 as well as a moderate but significant relationship between age and task (r = 0.4), t = (1,70) = 3.71,p <.05. When Grade was held constant, however, the association Age x Task disappeared (r Age x Task . Grade = 0.032) indicating that it was dependent mainly on the literacy level rather than Age. This was not the case when Age was statistically controlled for. The Grade x Task correlation continued to be considerable (r Grade x Task . Age = 0.66).

These results clearly demonstrate that while performance was dependent on the literacy level of the child Ss, there was no increase in performance with age.

The tests based on the data from literate children yielded no relationship whatsoever between either Age and Task Score (r = 0.12) or Grade and Task (r = 0.024). Means were 68.5% for Grade 2 and 74.37% for Grade 1.

To summarize to this point, the results are straightforward. They clearly demonstrate that correct identification of the initial segment increased with increasing literacy and that age did not affect performance in any significant way.

2. Linguistic Variables

As evident in the design section above, the design makes it possible to assess the effect of some linguistic variables on the Ss' ability to attend to and identify the initial segment. Though no specific predictions were made, it was expected that performance might vary (i) with whether the initial segment was an obstruent (plosive, fricative) or a sonorant (glide, liquid, nasal): Segment Type Factor and (ii) with whether the initial segment was part of a consonant cluster (ie CC confirguration) or followed by a vowel (ie CV configuration): Context Factor.

2.1 Analysis and Findings

The procedure and method for the statistical analyses followed those in the previous experiments.

2.1.1 Effect of Initial Segment Type

A visual inspection of the data displayed in Table 6.5.3 reveals that overall performance appears to vary with the type of initial segment. Thus, there was a general tendency to identify initial segments more correctly when they were fricatives ($\bar{X}$ = 58.76%) than when they were plosives ($\bar{X}$ = 51.20%) or sonorants ($\bar{X}$ = 46.61%). This is particularly marked in the case of the illiterates.

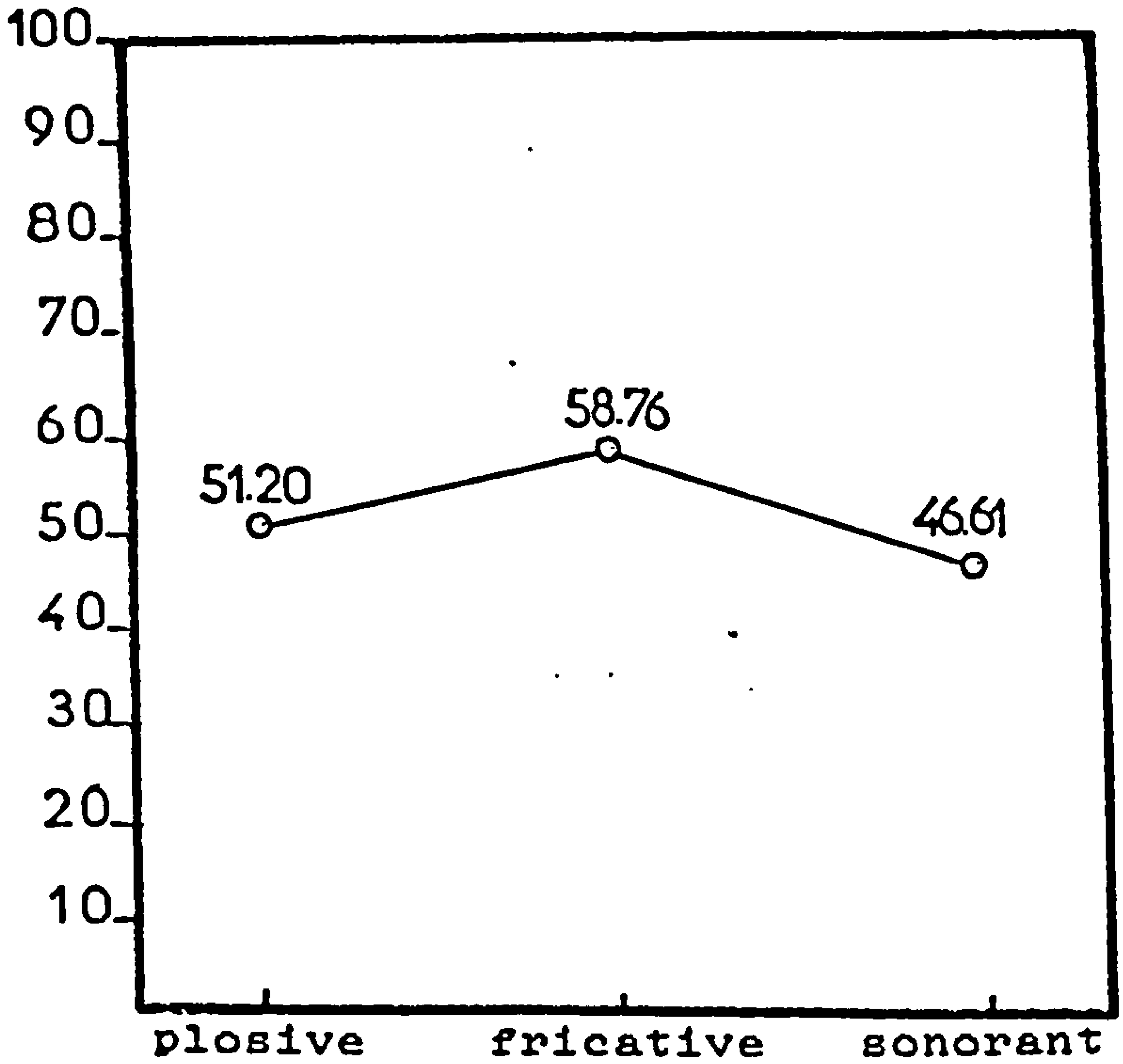
	INITIAL SEGMENT TYPE					
	Plosive		Fricative		Sonorant	
CHLIT	75.87	(21.7)	73.79	(19.62)	64.64	(27.78)
CHILT	22.64	(22.19)	34.79	(25.89)	22.40	(19.27)
ADLIT	76.15	(20.64)	85.04	(18.77)	75.16	(21.09)
ADILT	30.14	(24.36)	41.43	(28.08)	24.24	(23.17)

EXPERIMENT 5 - Table 6.5.3: Mean percentage correct responses as a function of Age, Literacy, type of initial segment (plosive, fricative, sonorant). Standard deviations are in parentheses.

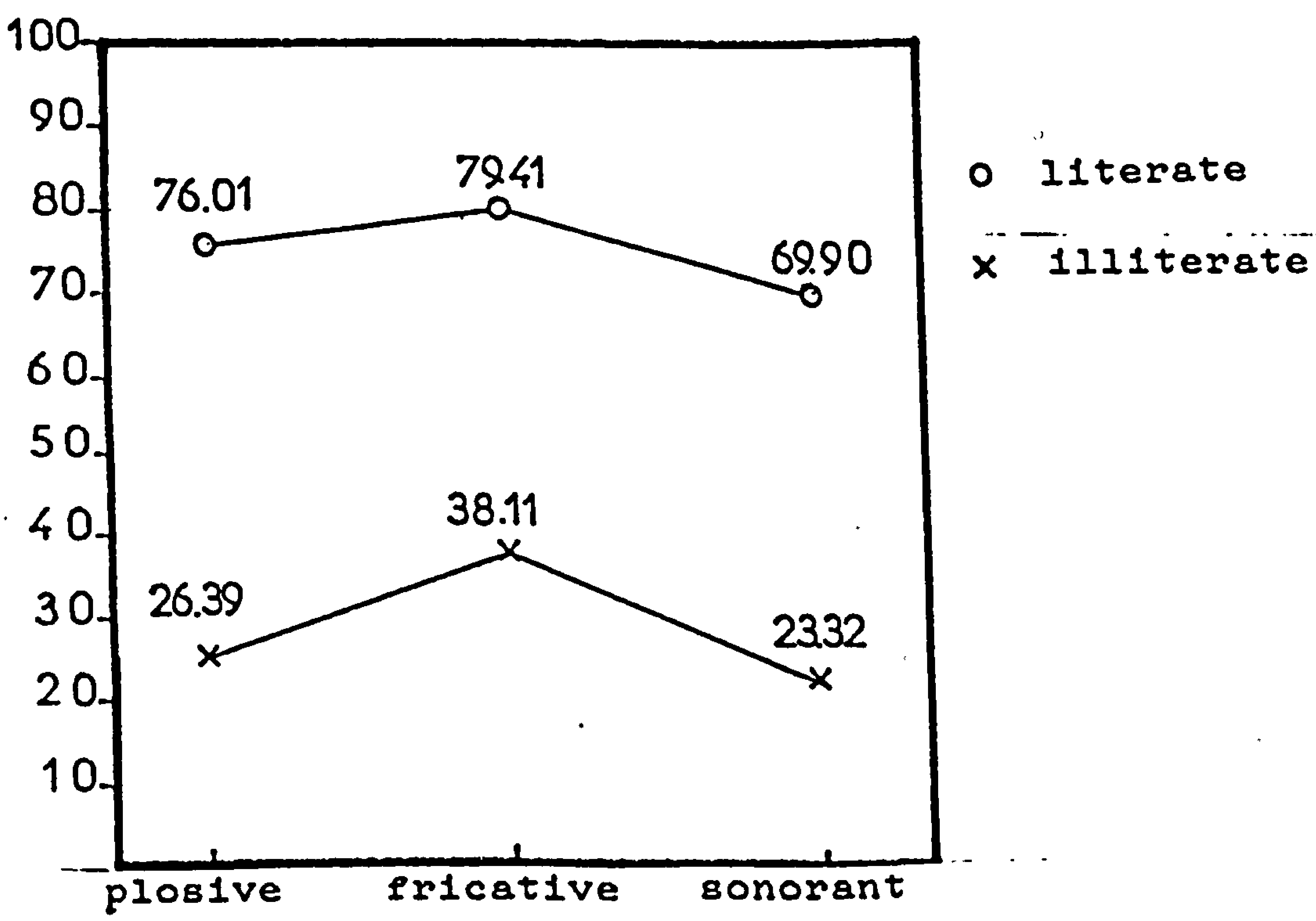
These differences were found to be reliable across Ss (F_1 (2,224) = 15.48,p <.0001 but not across stimuli (F_2 (2,30) = 0.83,n.s). Figure 6.5.C summarizes this result.

Results of the ANOVA also indicated that while overall performance varied with the type of target segment (ie whether it was a plosive, a fricative or a sonorant), both age groups were sensitive to the same type. This is shown by the absence of an Age x Segment Type interaction (F_1 (2,224) = 2.68,p >.0.07; F_2 (2,30) = 1.54, n.s.). Means for children and adults were 49.25% vs 53.14% for plosives, 54.29% vs 63.23% for fricatives and 43.52% vs 49.7% for sonorants.

The Literacy Segment Type interaction, on the other hand, was found to be reliable although only across Ss (F_1 (2,224) = 4.16,p <.01). The presence of this interaction was essentially caused by the fact that the illiterates' performance depended on whether an initial segment was a



Experiment 5 - Fig. 6.5.C: Mean percentage correct responses as a function of the type of target segment



Experiment 5 - Fig. 6.5.D: Mean percentage correct responses as a function of literacy and segment type plosive ($\bar{X}$ = 23.32%), a fricative ($\bar{X}$ = 38.11%) or a sonorant ($\bar{X}$ = 23.32%) whereas the literates seemed to be less able to perform when the initial segment was a plosive ($\bar{X}$ = 76.01) than when it was a fricative ($\bar{X}$ = 79.41%), though they were less successful when it was a sonorant ($\bar{X}$ = 69.9%). Furthermore, the difference between the two literacy groups was more pronounced on plosives than on liquids or fricatives (Scheffé $p < .05$). These results are portrayed in Figure 6.5.D.

2.1.2 Effect of Context

In this section we examine the possibility that decisions on the initial segment would depend on the immediate following context. It will be recalled that the materials employed were varied systematically according to whether the target segment was part of a CC confirguration or a CV confirguration. There was reason to believe that it would be easier to identify the target segment when it was part of a CV than a CC configuration.

As presented in Table 6.5.4 below, however, the data clearly indicated that there were consistently almost twice as many correct responses when the initial segment was part of a CC configuration ($\bar{X}$ = 68.28%) than when it was part of a CV configuration ($\bar{X}$ = 35.17%) with the literates scoring better than the illiterates.

	CONTEXT			
	CV		CC	
CHLIT	50.10	(31.20)	92.77	(16.34)
CHILT	15.92	(19.08)	37.30	(22.98)
ADLIT	56.98	(33.14)	96.92	(4.31)
ADILT	17.71	(23.13)	46.15	(27.11)

EXPERIMENT 5 - Table 6.5.4: Mean percentage correct responses as a function of Age, Literacy and context (ie whether initial segment is followed by a consonant or a vowel).

Not surprisingly, these differences were found to be very highly reliable (F_1 (1,112) = 151.52,p <.0001; F_2 (1,32) = 60.56,p <.0001; min F,' p <.01). This result is displayed in Figure 6.5.E

Of the two possible main interactions, only Literacy x Context was significant both by Ss (F_1 (1,112) = 9.72,p <.002 and by materials (F_2 (1,32) = 9.30,p <.004; min F' (1,100) = 4.64,p <.05). Essentially, the emergence of this two-way interaction, which is plotted in Figure 6.5.F, appears to indicate that although the literates outperformed the illiterates, the difference between the two groups was greater for CC ($\bar{X}$ = 94.84% vs 41.72%) than for CV ($\bar{X}$ = 53.54% vs 16.81%). Futhermore, the overall effect of context was more pronounced for the literate group than for the illiterate group. (Scheffé, p <.05). This can be attributed to the fact that literates scored close to ceiling level on the CC configuration. An inspection of the distribution of the scores revealed that 44 literate Ss (or 73.33%) including 23 children (or 63.88%) and 21 adults (or 87.5%) scored 100% on CC configuration, the lowest score being 67.5%.

The results from the linguistic variables thus revealed:

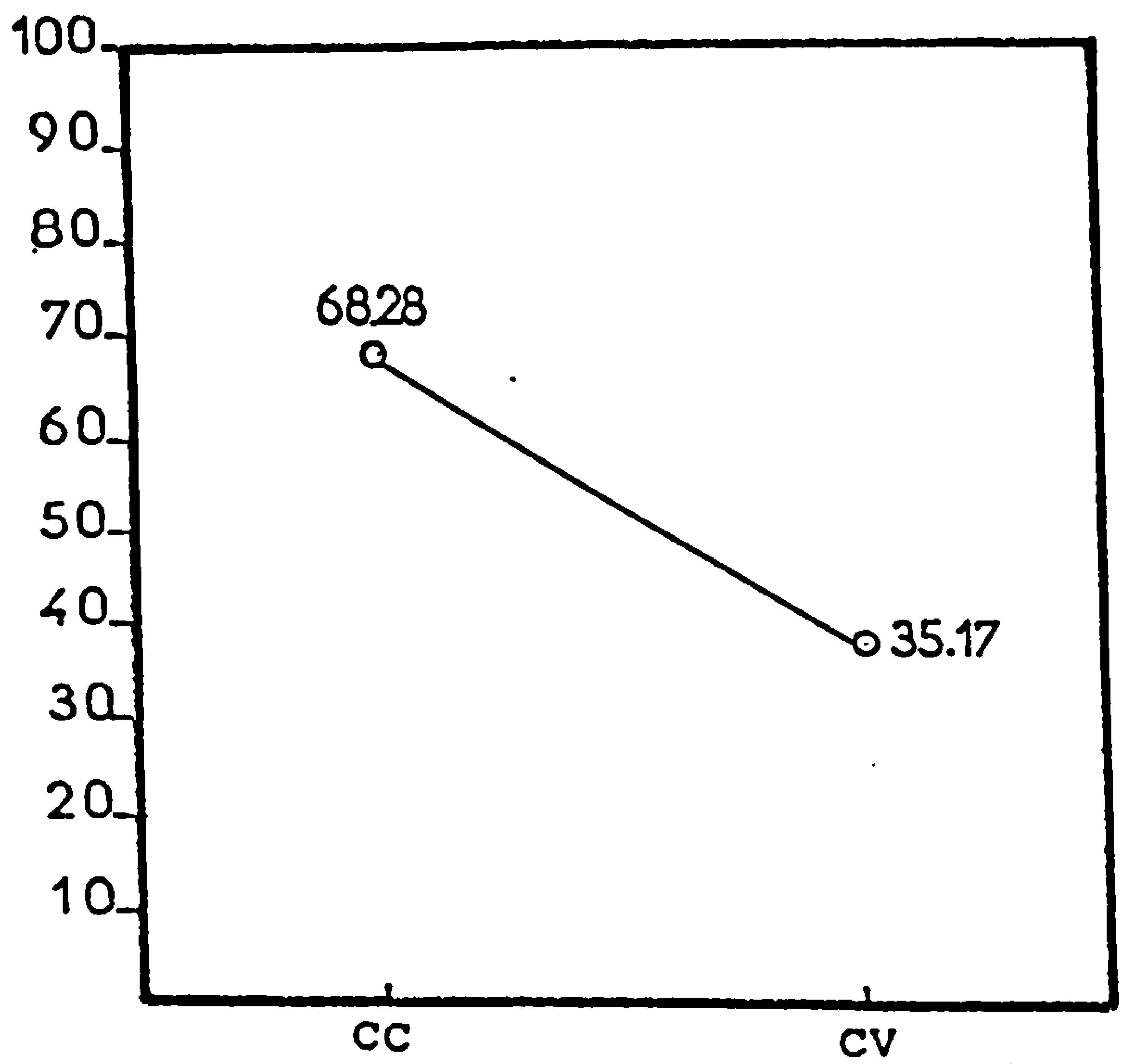
(i) different patterns for initial segments depending on whether they are part of a CV or CC configuration with strong effect on the adjacent segment in the former configuration. This affected all Ss regardless of age and literacy, though it was more pronounced in illiterates.

(ii) certain target types were more accessible than others. Thus, fricatives led to better performance than plosives which in turn led to better performance than sonorants. This, however, was generalisable only across Ss, with the illiterates being more affected than the literates.

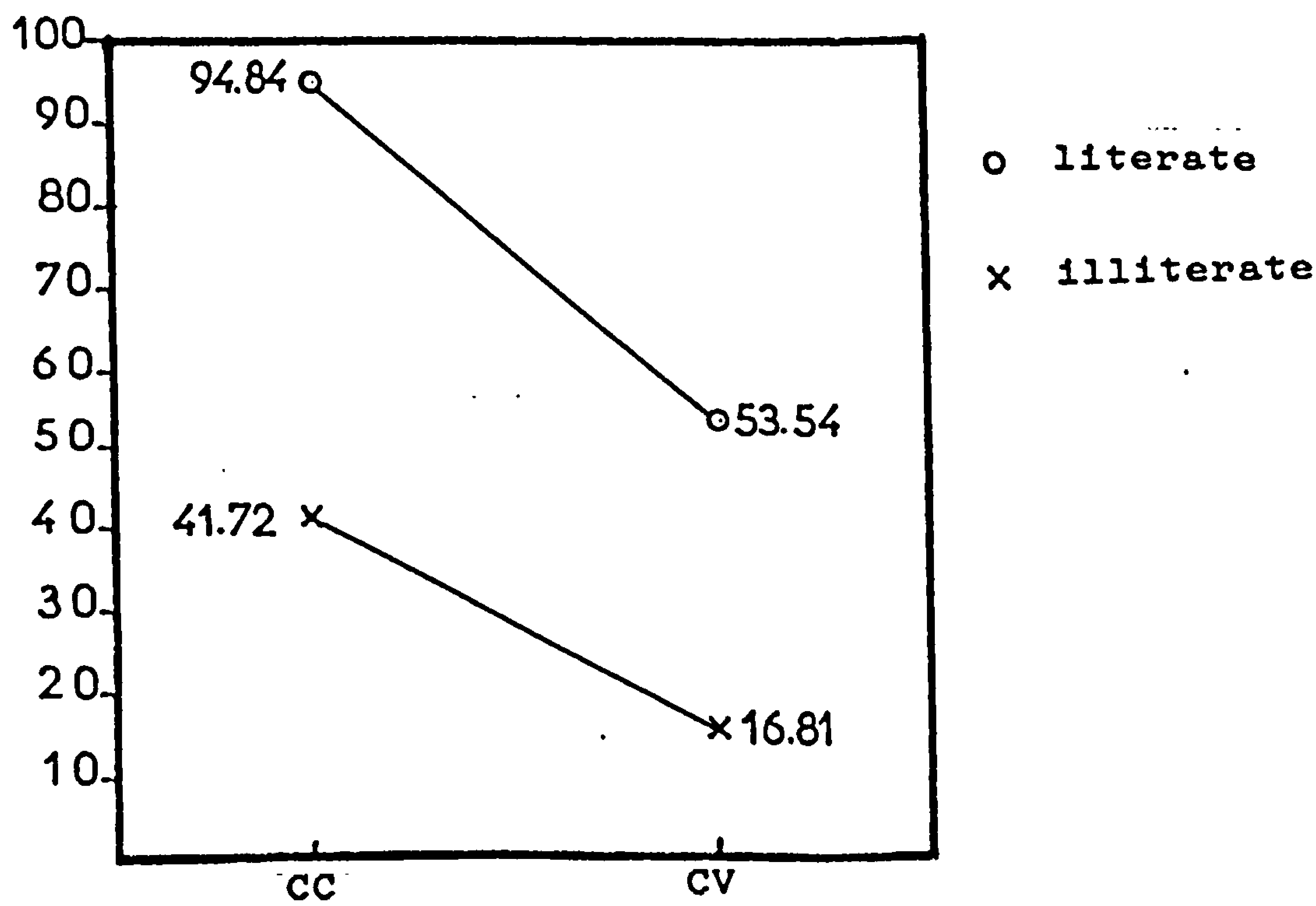
In order to determine which of the two linguistic factors (ie context vs segment type) was directing the Ss' choices, we carried out another analysis.

An unequal cell-size four-way ANOVA (Age x Literacy x Segment Type (Plosive, Fricative, Sononrant) x Context (CC, CV) was performed.

The expected Context x Segment Type interaction was not found to be reliable. No other interesting effect was recorded. Means are displayed in Table 6.5.5, below which indicate that CV configurations containing initial segments differed from CC configurations containing



Experiment 5 - Fig. 6.5.E: Mean percentage correct responses as a function of context (CC vs. CV)



Experiment 5 - Fig. 6.5.F: Mean percentage correct responses as a function of literacy and context the same segments.

	CV					
	Plosive		Fricative		Sonorant	
CHLIT	57.62	(14.84)	47.89	(7.82)	43.27	(13.12)
CHILT	18.25	(15.03)	21.44	(14.03)	00.00	(00.00)
ADLIT	54.61	(8.37)	67.32	(14.62)	50.31	(10.48)
ADILT	23.44	(12.35)	22.32	(14.20)	00.00	(00.00)

	CC					
	Plosive		Fricative		Sonorant	
CHLIT	95.58	(5.17)	99.32	(1.52)	84.93	(1.60)
CHILT	26.51	(12.59)	48.48	(11.34)	45.28	(15.29)
ADLIT	100.00		100.00		98.91	(2.02)
ADILT	36.21	(16.58)	60.82	(17.13)	47.97	(4.80)

EXPERIMENT 5 - Table 6.5.5: Mean percentage correct responses as a function of Age, Literacy, context (CV, CC) and Segment Type (Plosive, Fricative, Sonorant). Standard deviations are in parentheses.

The absence of Context x Segment Type interaction confirms Ss' preference for CC configuration over CV configuration, on the one hand and supports CC configuration over Segment Type, on the other. Put another way, both Segment Type and Context are important, but when they work against each other, Context is dominant.

We interpret this outcome as an indication that there is a tendency for Ss to treat CV configurations as more cohesive units than CC configurations. This is not in the direction predicted by Treiman's (1980, 1982) assumption that consonant clusters are more cohesive than CV configurations and by her finding that it was easier for American Ss to identify initial segments when they were part of a CV than when they were part of a CC configuration.

In order to account for our findings, we can interpret the data differently. We propose that identification of an initial segment is dependent on the relationship between the target segment and its syllable in the stimulus word. We assume that the initial syllable serves as a kind of framework for locating and identifying the initial segment. Thus, when presented with a word whose syllabic structure is C_1C_2V, Ss do not find it difficult to dissociate C_1 from the rest of the word because the syllable is not destroyed even if C_1 is deleted. In CVC configurations, however, Ss fail to dissociate the initial consonant from the following vowel because, according to the syllabic structure hypothesis, this would destroy the syllable. Put another way, C_1C_2V minus C_1 = C_2V which _is_ a syllable, while C_1VC minus C_1 = VC which is not. Our explanation agrees with the fact that, unlike English, Arabic does not tolerate V or VC as syllable configurations.

These results imply that a cohesive onset cluster hypothesis as suggested by Treiman (1980, 1982) is not applicable to speakers of Moroccan Arabic. Our Ss failed to extract the initial consonant in CVC in order to prevent violation of a principle of phonotactic regularity which is probably learned early in development - namely, that Arabic does not tolerate either V or VC as syllable configurations.

Some behavioural evidence is available which suggests that our analysis of the data is plausible. This comes from two sources. First, a preliminary analysis of a limited corpus of speech errors in Moroccan Arabic collected by the author indicates that there is a tendency for 'breaks' to fall within consonant clusters (ie C/C) rather than outside and after the vowel rather than before it in CV configurations (ie CV/C). Second, in an informal post-hoc experiment which involved only a small number of Ss and stimuli, both literate and illiterate adults were found to be more able to play a Pig Latin-like game (ie move the initial segment of a word to the end of the word and add /ei/) when the initial segment was part of a CC configuration in which case they moved the whole initial CV syllable to the end of the word.

The present results have implications for theories of syllable structure and research in speech perception. First, in syllabic theory, they are inconsistent with views that assume cohesive onset clusters. Rather, it can be suggested that they tend to support the hypothesis that the initial segment in a consonant cluster is a "stray segment" or "extrasyllabic" (Clements and Keyser, 1983). According to Clements and Keyser, an extrasyllabic consonant is one which is not a member of any syllable. They suggest that the first element in a cluster would not be a constituent of the syllable at the same level as the onset and the rhyme [10]. Typically, such consonants are historically susceptible to processes which either eliminate them or turn them into well-formed syllables by means of processes such as degemination, vowel epenthesis, sonorant vocalisation, and metathesis (Clements and Keyser, 1983). This notion, however, is in need of clarification, so we shall not pursue it further except to note that, according to Clements and Keyser's typology, Moroccan Arabic would be considered a Type III language which exhibits the following primary core syllable types: CV and CVC whereas English, a type IV language, has the following primary core syllable types: CV, V, CVC, VC. This is compatible with our findings.

Second, the present results also have implications for research in speech perception. They are in keeping with the argument that the syllable is perceived (Savin and Bever, 1970) or identified (Foss and Swinney, 1973) before the segment and that recognition of the latter depends on the former. In Savin and Bever (1970), Ss were required to detect as quickly as possible either the initial phoneme of a syllable or the syllable itself presented in a list of nonsense syllables. It took Ss longer to detect phonemes than syllables. This led Savin and Bever to conclude that phonemes are not perceived directly but are derived from an analysis of the syllabic perceptual unit. Interpretation of these results have come under a certain amount of attack (eg McNeill and Lindig, 1973; Healy and Cutting, 1976; Swinney and Prather, 1980; Mills, 1980). However, these critical studies themselves were found to suffer from serious methodological weaknesses (see Mehler, 1981).

Recently, Mehler et al (1981) have also demonstrated that the time to detect a sequence of phonemic segments depends on the syllabic status of this sequence in the target word. For example, the sequence /ka/ is detected faster than the sequence /kar/ in the French words 'carotte' (ca.rotte). The inverse result was obtained for the same targets in the word 'carton' (car.ton).

C. Summary and Conclusion

Our findings are very straightforward. There is no correspondence between the pattern of results observed in the present experiment and that in Experiment 2 which investigated initial syllable identification. Thus, unlike Experiment 2 which yielded no reliable effect of either age or literacy, the present task has demonstrated that correct responses increased with increasing literacy. Thus, while the literates' performance was quite high, both illiterate groups performed equally poorly.

These findings are corroborated by Morais et al's (1979) study which was a first attempt at examining the effect of explicit training on the ability to manipulate segments of spoken words. In that study, it was found that Portuguese illiterate adults were unable to add or delete a segment word-initially whether the stimulus was a word or a non-word. By contrast a matched group of adults with some instruction in reading performed the task well.

More interestingly, our findings revealed that response adequacy was a function of certain linguistic variables that were manipulated in the stimulus materials. First, our Ss were less aware of certain segments than others. This effect was more pronounced in illiterates. Thus, they were more aware of fricatives than plosives or sonorants. On the other hand, the literates' performance on fricatives and plosives was better than their performance on sonorants. This behavioural evidence, it is argued, is consistent with the linguistic notion of a sonority hierarchy, by which classes of consonants differ in their affinity with vowels.

Second, the present experiment has demonstrated that decisions on the initial segment do not seem to be made independently of the adjacent context. Rather there is a powerful context constraint on the location and identification of the target segment. This effect was significant irrespective of age or literacy, though it was more pronounced in illiterates. Ss seem to respond differently to stimuli sharing the first segment but having different syllable structure. Thus, it was easier to identify a segment when it occurred as the first element of a cluster (ie in a CC configuration) than when it was a singleton (ie in CV configuration). Evidence that the syllable serves as a kind of framework for segment location was shown to be very strong. On the other hand, Treiman's (1980, 1982) hypothesis that onset clusters are represented as a cohesive unit was not substantiated (but see a very recent paper by Cutler and Butterfield (1986)).

In sum, that the literates were by far more successful than both illiterate groups is a clear indication that the ability to attend to and manipulate the initial segment is not attained spontaneously as a result of general maturational change. It is not a general principle that knowledge of segments which may be involved in speech perception is readily available to conscious awareness. Specific training is needed to access them with any regularity. Literacy seems to promote awareness of the segment by providing the necessary critical cues. The initial segment seems to be available only to those who have mastered the phoneme-grapheme correspondence.

IV Experiment 6

A. Introduction

The data we have examined in Experiment 5 pertain only to one aspect of metalinguistic awareness of the segment, namely, the ability to attend to and consciously manipulate a consonant in word-initial position. This ability, it was shown, increased with increasing literacy. Irrespective of age, literates were by far more successful than illiterates who performed poorly. Experiment 5 also demonstrated that regardless of age or literacy, response adequacy was a function of certain linguistic variables. Thus, Ss were sensitive to whether targets were part of a CC configuration or a CV configuration with the former easier to identify than the latter. This, however, was more pronounced in the illiterates than the literates.

The present experiment was essentially designed and carried out to achieve three things. First, it allowed us to tap and assess the Ss' metalinguistic knowledge of the consonant in word-final position. As in Experiment 3 (Final Syllable Identification), we expect a position effect. Second, it also allowed us to assess Ss' awareness of the vowel. Vowels, it will be remembered, were not tested in the previous experiment since the phonological structure of the language does not allow them in word-initial position. Finally, the present experiment was also designed to isolate the effect of the orthographic factor already alluded to in the previous experiments. We reasoned that if orthography impairs the identification of the final segment when orthographic knowledge creates expectations which conflict with what is actually heard, then we ought to see some difference between the literates' and the illiterates' conceptualisation of the phonetic structure of the stimulus.

In the next three sections, we first try to show why we expect Ss' metalinguistic knowledge of consonants to be different from their knowledge of vowels. Then, we review some experimental work whose findings are interpretable as suggesting that knowledge of an orthographic system may be activated even in strictly auditory tasks. Finally, we discuss some spelling features which indicate that the orthographic structure of Arabic allows the methodological advantage that the relationship between spelling and awareness of sound structure may be tested directly.

1. Consonants vs Vowels

Intuitively and empirically, consonants and vowels seem to constitute different types of linguistic entities and appear to be under different motoric constraints (Kozheznikov and Chistovich, 1965). Two separate teleologies seem to be involved. On the one hand, it would seem clear that consonants are perceptually more important. Thus, in a script like Arabic or Hebrew, consonants are the only markers of words (letters). This agrees with the idea that they are semantically more salient. On the other hand, it would equally seem clear that vowels are acoustically more salient. Specifically, acoustic cues of vowels tend to be more invariant than acoustic cues of consonants (Liberman et al, 1967). In Gorman's (1981) words, vowels are "the more audible carrier waves of speech, broken up by the intrusion of less audible consonants" (p 107). Given the continuous nature of their perception, however, vowels tend to be somewhat labile as phonological entities. This is illustrated by the rôle they play in variation among dialects and the persistence of allophones within the same geographic locality (Liberman 1967). This may also explain why vowels tend to have more complex orthographic representations than consonants (eg English orthography).

In theories of syllable structure vowels and consonants have been treated differently. Thus, while vowels unquestionably hold a unique position within the syllable (such concepts as 'sonority hierarchy' or 'vowel cohesiveness' have been used in attempts to define the structure of the syllable itself), consonants, on the other hand have sometimes been considered as 'extrasyllabic' (see Experiment 5). For German, for example, Halle and Vergnaud (1980) propose that certain final consonants are not part of the syllable coda, but occur outside it, as an "appendix".

Some evidence from language behaviour also suggests that consonants and vowels constitute different kinds of linguistic entities, and, subsequently, may have different mental representations. Whereas the vulnerability of word final consonants to weakening processes like deletion is supported by both diachronic and synchronic phonological evidence (Hooper, 1973; Bell and Hooper, 1978; Wolfram and Fasold, 1974), vowels seem to be more resistant to loss, unconscious or unintentional misordering as in slips of the tongue and aphasic speech, or conscious misordering (intentional anomaly) as in paronomasia (Blumstein, 1973; Garrett, 1975; Lagerquist, 1980; Naucler, 1983).

In the MIT corpus (Garrett, 1975) which contains over 6,000 speech errors, single consonant errors outnumber vowel errors by a ratio of over 5 to 1. There are virtually no errors where a vowel is substituted for a consonant, nor a consonant for a vowel. This is taken to reflect the presence of structure beyond a linear string of segments in the representation of a lexical item. Likewise, phonological investigations of aphasic speech (Blumstein, 1973), reveal that vowels do not delete in aphasic omission errors, nor do they occur as often as consonantal substitution in paraphasic.

In a study of paronomasia (or the art of punning), Lagerquist

(1980) claims that consonants seem to be more available than vowels for punological purposes. For example, she reports that vowels figure in only 6% of deletions and just 23% of additions of a large corpus she examined.

The literature in speech perception, however, offers a confusing picture regarding vowels and consonants. For example, in a selective-attention task, where the same syllables were offered both for initial consonant and vowel identificaiton in different blocks, Wood and Day (1975) found faster RTS for the vowels than for the consonants (348 and 414 msec. vs 400 and 450 msec). This was not confirmed by Shand (1976) who used Ci Vi Cj Vj bisyllables in which either Cj or Vj were the target segments. In fact, there was a slight consonant advantage (296 vs 312 msec). In a completely different task (a word-list paradigm) employed by Savin and Bever (1970) considerably longer reaction times were recorded for vowels (470 msec) than for initial consonants (306 -354 msec) [11].

Research in reading acquisition also points to some differences between initial and final consonants on the one hand, and consonants and vowels on the other. Liberman _et al_ (1980) report a study in which second, third and fourth graders were asked to read aloud from lists of monosyllabic words in which the position (within the word) of consonant and vowel letters was systematically varied. A clear pattern of the children's errors emerged. _Consonants_ in the _final_ position were consistently misread about twice as often as those in the initial position. Although frequency of all consonant errors dropped markedly from the second through fourth grade, a 2:1 ratio of errors on final and initial consonants was maintained. Vowels yielded a very different result in that errors were independent of position and that, too, was found in all three grades.

This finding is also in harmony with another study on reading errors but which employed nonsense words. Treiman and Baron (1981) report that for first and second graders vowels were hardest, followed by final consonants, and initial consonants easiest. Even children reading Serbo-Croatian, which has a perfect spelling-to-sound regularity, were found to make more errors on final consonants than initial ones. However, vowels were not found to be harder than consonants (Lukatela and Turvey, 1980).

Finally, in addition to some work on dichotic listening which has been interpreted in terms of different hemispheric localization for consonants and vowels in speech perception, (Marcel in Venezky, 1980) there appears to be some neurological basis for the difference between consonants and vowels. Sussman (1984) has developed a theory of neurological organisation which proposes a specific neuronal model of representing sublexical and lexical items. Concerning consonants and vowels, Sussman claims that "vowels are neurologically differentiated from consonants by being established concurrently with the canonical syllable frame of the language, and hence neuronally conceived to be an intrinsic component of the structural syllable itself." (p 93). By being part of the neuronal configuration of the syllable frame, "the vowel is not synaptically linked to a slot, it is the slot" (p 101).

Consonants, on the other hand, "maintain a separate representation from the slot and only become an occupant by virtue of excitation to a consonantal slot surrounding the vowel." (p 101). Support for this model is sought from neurophysiology, second language learning mispronunciation, phonotactic contstraints and the ubiquitous maintenance of the integrity of phonological constraints in brain-damaged speakers. Nevertheless, more experimental data together with clinical observations are needed to support all of these arguments.

In sum, and in view of some of the evidence reviewed above, we conclude that there are indications that some differences - perceptual or otherwise - may exist between consonants and vowels on the one hand, and between initial and final consonants on the other, especially in their importance in a writing system [12]. To what extent, we ask, might these differences be also reflected in the metalinguisitic knowledge of literate and illiterate children and adults who are required to attend to and consciously manipulate consonants and vowels in word-final position? This is what the present experiment seeks to investigate.

2. Influence of Orthographic Representation

As previously mentioned, another aim of the present experiment was to isolate the effects of the orthographic factor already alluded to in most of the previous experiments.

That orthographic representations may influence speech classification is suggested by Read's research (1973, 1978). Read (1973) conducted a study in which first graders, second graders, and adults were required to decide whether nonsense words beginning with /tr/ were more like words beginning with /tʃ/ or with /t/ (eg whether /troz/ sounds more like 'chose' or 'toes'). It was found that first graders who had been taught the <tr> spelling tended to identify nonsense words beginning with /tr/ with real words beginning with /t/. However, first graders who had not learned about the <tr> spelling tended to identify the same nonsense words with real words beginning with /tʃ/. Most adult Ss tended to select /t/ responses, although a few consistently selected /tʃ/ responses, and second graders were intermediate between adult and first graders.

Similarly, Barton, Miller and Macken (1980) conducted a study in which they taught preschoolers to segment the first sound in words, such as /m/ in 'mouse' and 'b' in 'bear', and found that prereaders treat the affrication in word-initial position in 'train' and 'chair' as the same single sound /tʃ/, whereas beginning readers regard the initial sound in 'train' as more like 'teddy' than 'chair' and analyse <tr> as two sounds rather than one.

In a different study, Read (1978) notes that adults typically judge that the vowels of 'bet' and 'beet', 'bat' and 'bait', and 'bite' and 'bit' are related pairs because of the similarities in spelling, even though these pairs are not especially similar phonetically.

Some evidence is also available which suggests that orthographic knowledge is a source of psychologically real linguistic knowledge. Jaeger (1979) conducted a concept-formation experiment in which adults native speakers of English learned to distinguish positive from negative instances of vowel-shift alternations for pairs of words (eg deceive-deception (positive instances) and false-fallacy (negative instances)). Ss were then presented with test items to determine how they were responding on the basis of the vowel shift rules (Chomsky and Halle, 1968) or spelling rules. It was hypothesised that if Chomsky and Halle's phonological system governed performance, then Ss should consider "abound - abundant" a positive instance and "presume - presumption" a negative instance. If spelling rules governed performance, however, we should get an opposite result. The latter prediction was supported by the results. It is argued that knowledge of an orthographic code is a possible source of psychologically real linguistic knowledge. This was already shown by Moskowitz (1973) who concluded that Ss performance was not due to their knowledge of vowel shift rule in the Chomsky and Halle sense but rather to their knowledge of spelling rules. In a similar vein, Michaels (1980) tested eleven- and fifteen-year-old children's knowledge of vowel tensing alternations in English (eg manager - managerial). When the words were presented orally, the children had no inkling as to the pronunciation of the tensing alternations. When, however, they were shown the spelled representations of words like 'Newton' and 'mammal', they had no difficulty providing the correct pronunciation of the tensed vowel in the derived forms 'Newtonian' and 'mammalian'. Informal tests were also given to adults. They were required to give the derived form (on the model of 'Newtonian') for non-words like 'zinken'. The usual response was to retain the schwa in the pronunciation of the derived forms. When the same adults were presented with various spelled versions of 'zinken' (eg zinkan, zinkun, zinkon, zinken), they typically gave the spelling pronunciation of the letter name of the vowels A, U, O, E.

In a different type of task, Derwing and Baker (1979) and Derwing (1984) used judgmental techniques to study the psychological reality of the morpheme. They asked children if certain words seem related to each other, if one came from the other (eg cup-cupboard, errie-ear, holiday-holy), and then they required their Ss to rate the sureness of their responses. The results of the study suggest that knowledge of certain higher-order rules of derivational morphology may indeed be dependent upon knowledge of orthographic structure. That is, the mastery of literacy may help organise one's 'meanings' in the sense that the meaning of different words such as 'numerous-number' or 'precious-price' become apparent because of their related spelling patterns.

In summary, there are certain facts as well as certain lines of evidence which can be taken to indicate that spelling stored in memory can influence performance even in strictly auditory tasks requiring listeners to process and respond to spoken words.

3. Arabic Orthography: Some Relevant Features

One factor that may influence a literate's reliance on either a phonemic or a graphemic code is the manner in which the phonology of his language is presented by its orthography. For example, if the writing script uses two different symbols for the same sound, the literate may regard them as mentally different. This prediction is, of course, derived from our general hypothesis that knowledge of a writing system alters our intuitions about language. In what follows, we briefly discuss some features of the Arabic orthographic system which are of interest to the present experiment.

Unlike Serbo-Croatian which has a phonologically shallow orthography, that is, an invariant spelling-to-sound regularity (Lukatela et al, 1980), English, for example, has an orthographic structure which is phonologically deeper and thus graphemically and phonemically more or less opaque. Its spelling system maps onto an abstract level, that is, the morphophonological level (Chomsky and Halle, 1968).

Likewise, written Arabic is a language whose orthography, when compared with English, is even less phonemically specific. It can be said to represent phonemic information even more indirectly than English does in that it operates to preserve a simpler relationship between spelling and morphophoneme at the cost of a more complex relation between spelling and sound (see Bentin and Bargai (1984) and Koriat (1984) for Hebrew). Two features of this orthographic structure are relevant to the present experiment.

First, the orthography of Arabic has two forms of spelling, vowelised (ie fully marked) and unvowelised. In the unvowelised form which is the more traditional and the more widely used, letters carry mostly consonantal information, whereas most vowels are generally not directly expressed by any letters or diacritical marks. However, unvowelised spelling may contain some vowel information. Thus, in addition to their function as consonants, in some words, such letters as <waw , ya> may express the long phonemes /u/ and /i/, respectively. Vowelised spelling, on the other hand, supplies (short) vowel information which is expressed not by letters but by small graphic symbols (diacritical marks) which are appended to the consonants but cannot stand by themselves.

A second feature of Arabic orthography is that it uses, in at least one case, two different symbols to express the same phonetic sound. Thus, while it uses a consonant symbol to express [n] in /qa:nu:n/ 'law', the same phonetic sound is expressed by a double diacritic appended to the terminal root consonant in the word /kita:bun/ 'a book' (root is KTB). In this second example, the [n] functions as the indefinite marker. It should be pointed out, however, that except for instructional materials in the early grades, children's readers, and the Koran, diacritical marks representing short vowels and the indefinite marker are omitted altogether in a great portion of the printed matter that children are exposed to in daily life (books, newspapers, television). The reader identifies the words using the information supplied by the consonant letters and his knowledge of the characteristic morphological and syntactic patterns of the language which impose strong constraints on the possible distribution of vowels (see Experiment 4). To a large extent the linguistic contrasts realised by vowels are grammatical rather than lexical.

These features of the Arabic orthographic system provide the methodological advantage that the relationship between spelling and awareness of the sound structures of words may be tested directly. In particular, they offer a unique opportunity to test the hypothesis that orthographic knowledge creates expectations which conflict with what is actually heard. We predict, for example, that if literate Ss have an internal written representation of words, this might cause them to organise information about certain final segments (eg indefinite marker) according to orthographic rather than phonological representation.

B. Method

1. Materials and Design

Thirty-six experimental words in varying length and syllabic structure were constructed such that there were two sets (A and B) each containing 18 stimuli (see Appendix E). Half the Ss in each sample received one set, and the other half the second set. The test stimuli were randomised with respect to the type of final segment (ie whether consonant or vowel) each contained.

The materials employed in the present experiment were selected to vary the following factors:

(1) the length of the stimuli which were either mono-, bi-, or trisyllabic (LENGTH FACTOR). Treiman's (1980) findings indicated that it was harder for 4- and 5-year-old children to recognise a phoneme in two-syllable items than in one-syllable items.

(2) the type of final segment which had two levels: consonant and vowel (FINAL SEGMENT TYPE FACTOR).

(3) the type of segment preceding the target segment which had two levels: vowels and consonants (CONTEXT FACTOR). Here, we proposed to control for the degree of cohesiveness between final consonants and preceding consonants or vowels, on the one hand, and final vowels and preceding consonants, on the other hand. Specifically, we were concerned with whether consonant clusters are cohesive when they form a coda. It has been shown, with respect to English, that a vowel is far more cohesive with a following consonant (VC #) in the same syllable than with a preceding consonant (C/V #) (Stemberger, 1983).

(4) the orthographic form of the final segment. To test the hypothesis discussed earlier, that orthographic knowledge creates expectations which conflict with what is actually heard, words sharing the same terminal segment phonetically, but orthographically represented differently, were included in the design. The inclusion of the two words /kita:bun/ and /qirdun/ (the indefinite nominative forms for 'book' and 'monkey', respectively) [13] permitted the following

prediction to be made: If literate Ss have an internal written representation of words, this might cause them to organise information about the final [n] according to orthographic rather than phonological representation.

Table 6.6.1 below, displays the distribution of stimuli.

	TYPES OF FINAL SEGMENT		
	LENGTH	CONSONANT	VOWEL
Monosyllabic	12	6	6
Bisyllabic	18	6	6
Trisyllabic	6	6	6
	36	18	18

EXPERIMENT 6 - Table 6.6.1: The distribution of stimuli as a function of length of stimuli (monosyllabic, bisyllabic and trisyllabic) and type of final segment (ie whether the final segment is a consonant or a vowel).

2. Procedure

The present experiment employed the same procedure as in Experiment 3 (Final syllable) except that Ss were required to identify the final segment instead of the final syllable in the knock-knock game [14].

C. Results and Discussion

1. Subject Variables

Scoring and Data

The scoring procedure was similar to the previous experiment. A response was scored when the terminal segment was identified. The means and standard deviations for the correct items identified are displayed in Table 6.6.2.

		LITERACY			
		Literate		Illiterate	
AGE	Child	43.82	(2.77)	8.94	(15.40)
	Adult	54.61	(15.15)	24.30	(18.38)

EXPERIMENT 6 - Table 6.6.2: Mean percentage of correct responses as a function of age and literacy. Standard deviations are in parentheses.

1.2 Analysis and Findings

1.2.1 ANOVA

The data were analysed as in the previous experiment. Raw percentage scores were subjected to a three-way ANOVA 2 (Age (child, adult)) x 2 (literacy (literate, illiterate)) x 2 (Group (A, B)).

As portrayed in Figure 6.6.A, the effect of Age was significant both by Ss (F_1 (1,112) = 26.15,p <.0001) and by materials (F_2 (1,34) =

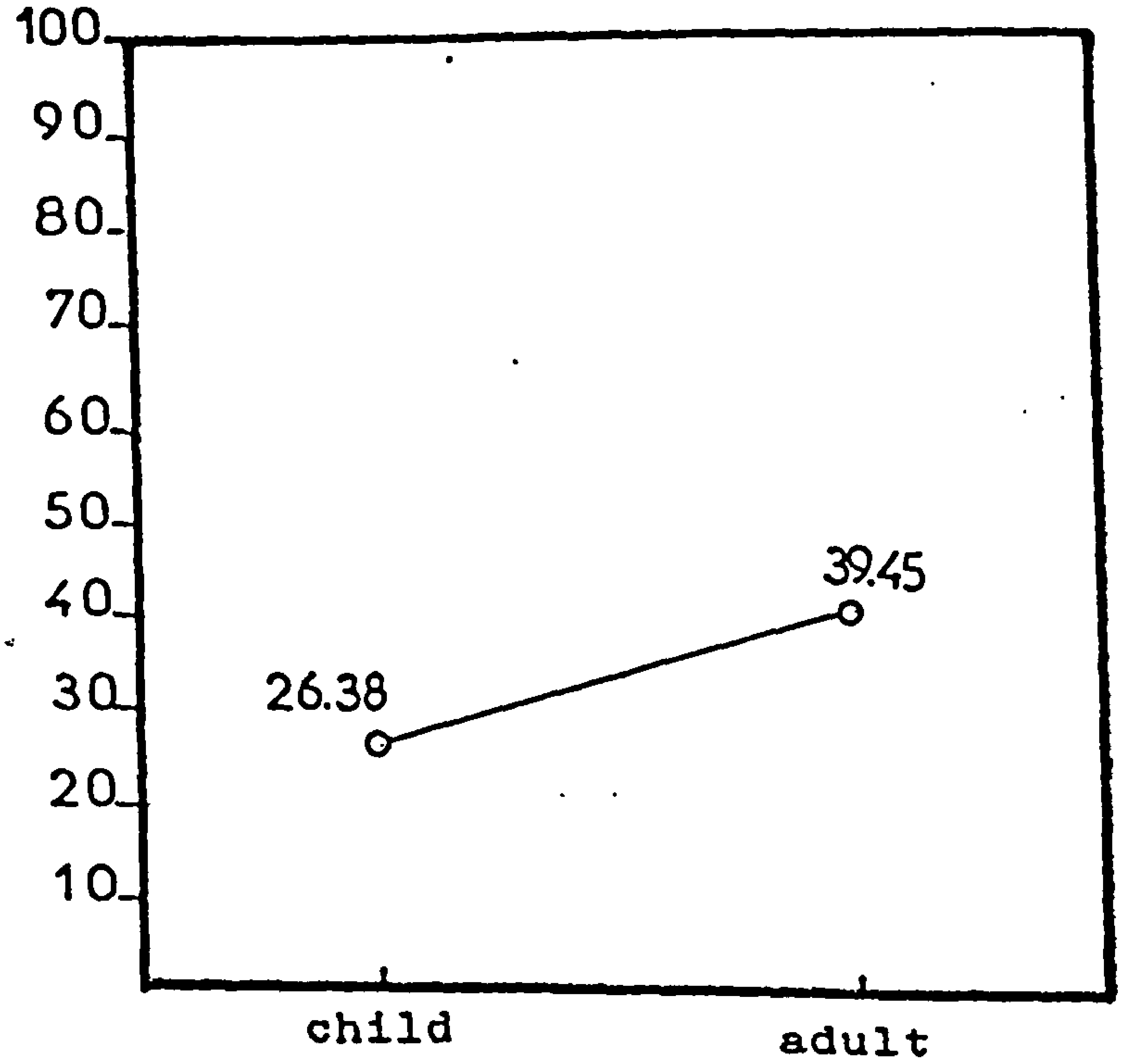
74.65,$p < .0001$); min F' (1,145) = 19.35,$p < .01$. Means for the child and adult Ss were 26.38% and 39.45%, respectively.

The effect of literacy was very highly reliable across Ss (F_1 (1,112) = 162.45,$p < .0001$) and materials (F_2 (1,34) = 31.98,$p < .0001$), min F' $p < .01$. Means for the literates and the illiterates were 49.21% and 16.62%. Figure 6.6.B plots this result.

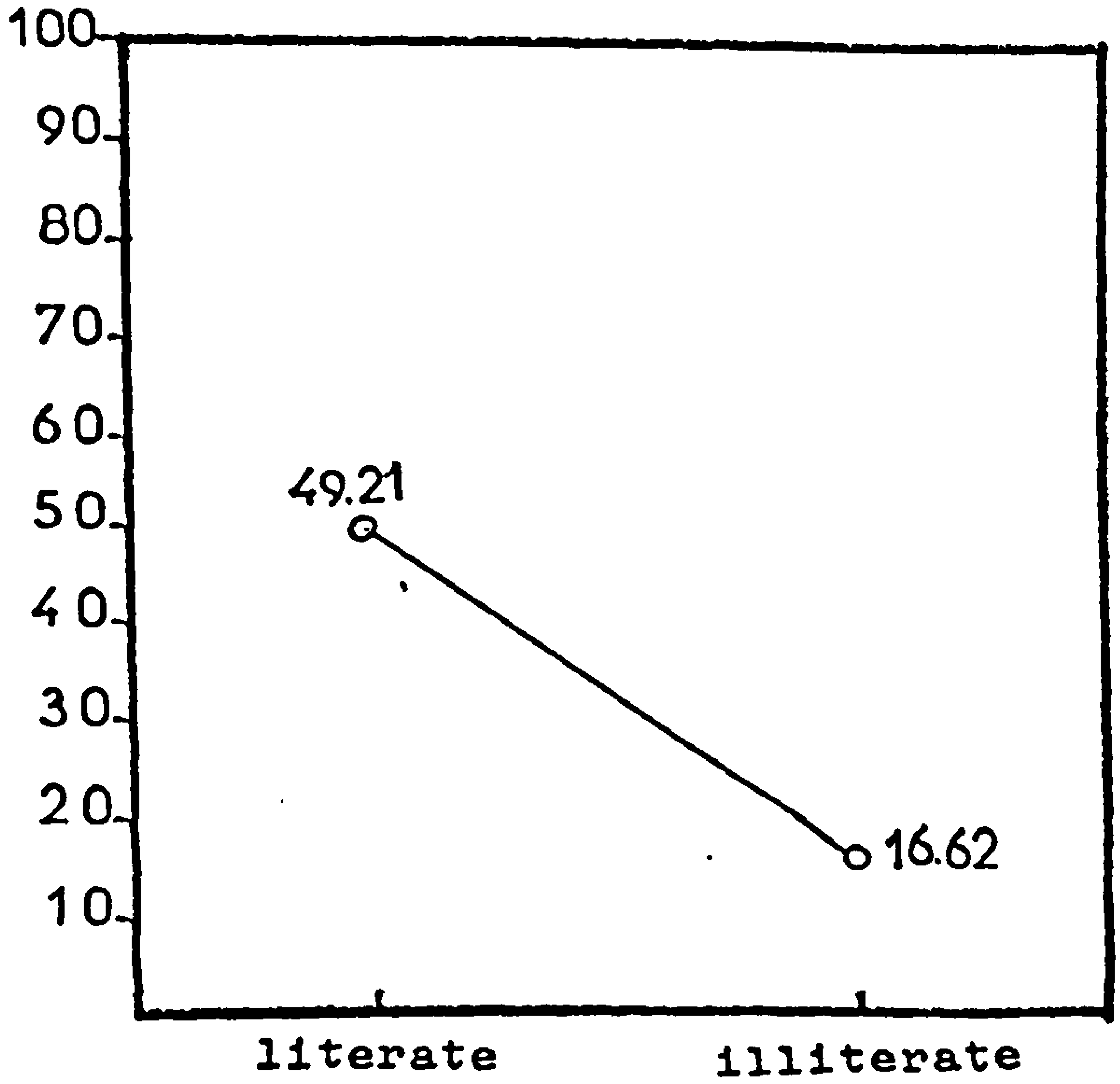
The Age x Literacy interaction was not found to be reliable by Ss (F_1 (1,112) = 0.79,n.s.) and only marginally so by materials (F_2 (1,34) = 4.26,$p < .04$). We will not discuss it further.

1.2.2 Correlation Tests

As in the previous experiments, correlation tests assessed the three-way relationship between the children's chronological age, their level of literacy and their task score. The tests disclosed a high degree of correlation between the children's literacy level and their task score ($r = 0.77$; $t = (1,70) = 7.53$,$p < .01$) as well as a significant correlation between Age and Task ($r = 0.66$; $t = (1,70) = 6.34$,$p < .01$). When, however, the level of literacy was controlled for in the latter correlation (ie Age x Task . Grade), the result yielded a very weak partial correlation with Age ($r = 0.29$). This suggests that the relationship between the children's age and their performance was mainly caused by their level of literacy. When, on the other hand, the Age factor was held constant, the correlation between literacy and task was



Experiment 6 - Fig. 6.6.A: Mean percentage correct responses as a function of age



Experiment 6 - Fig. 6.6.B: Mean percentage correct responses as a function of literacy

very much less affected (r Grade x Task . Age = 0.6), thus confirming the important influence of literacy on performance already yielded by the ANOVA results.

Correlation tests carried out on the literate children revealed only the most negligible relationship between either Age and Task (r = 0.06) or Grade and Task. Means were 45.05% and 42.59% for Grade 2 and Grade 1, respectively.

Summarizing, the overall outcomes of the by-subject analyses are very clear. They reveal that response adequacy is highly dependent on literacy. Overall means were, however, modest. An analysis of the linguistic variables will help to explain why such low scores were obtained.

2. Linguistic Variables

As detailed in the design section, the materials of the present experiment were selected to vary the factors of length, segment type and context. Length was varied on three levels (whether stimuli comprising final segments were mono-, bi-, or trisyllabic). The segment type factor was varied on two levels (whether the target segment was a consonant or a vowel). Finally, the context factor was varied on two levels (whether the target segment was preceded by a vowel or a consonant).

2.1 Analysis and Findings

The procedure and method for the statistical analysis followed those in the previous experiment.

2.1.1 Effect of Length

An unequal cell-size four-way ANOVA with 2 (Age (child, adult)) x 2 (Literacy (literate, illiterate)) x 3 (Length (monosyl, bisyl, trisyl)) x 2 (Group (A, B)) was performed.

This analysis yielded only a marginal significant main effect of length by materials, $p < .052$) and no significant interaction. These results suggest that identification of the target segment was no more difficult when the target was part of a one-syllable word than when it was part of a two- or three-syllable stimulus. We will not discuss this result further.

2.1.2 Effect of Segment Type

Means and standard deviations for each age and literacy level are displayed in Table 6.6.3.

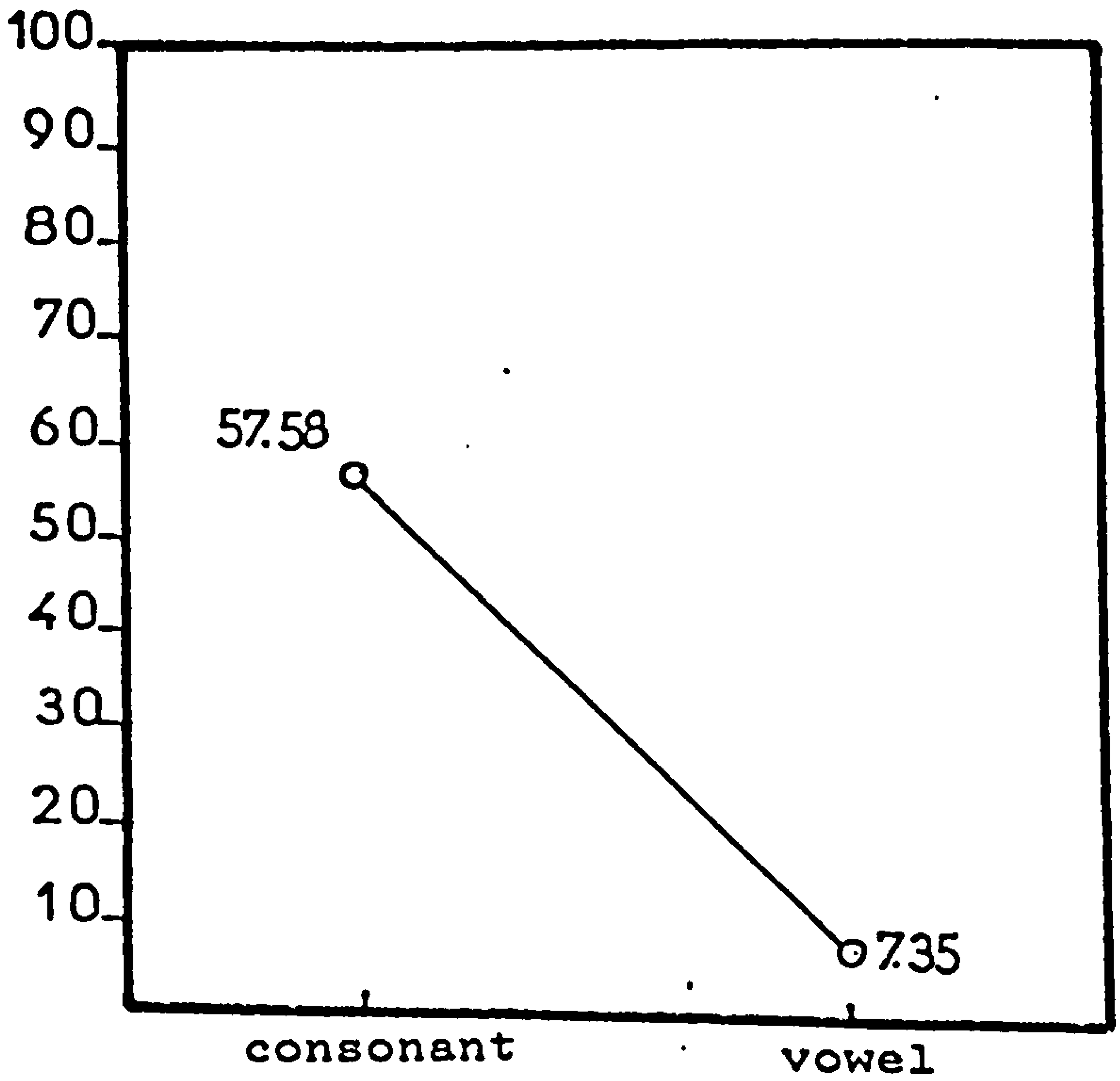
	SEGMENT TYPE			
	Consonant		Vowel	
CHLIT	83.32	(14.05)	1.23	(2.85)
CHILT	16.96	(30.30)	0.92	(2.16)
ADLIT	88.42	(6.21)	17.12	(25.68)
ADILT	41.65	(26.58)	10.14	(16.03)

EXPERIMENT 6 - Table 6.6.3: Mean percentage correct responses as a function of Age, Literacy and type of final segment (consonant vs vowel). Standard deviations are in parentheses.

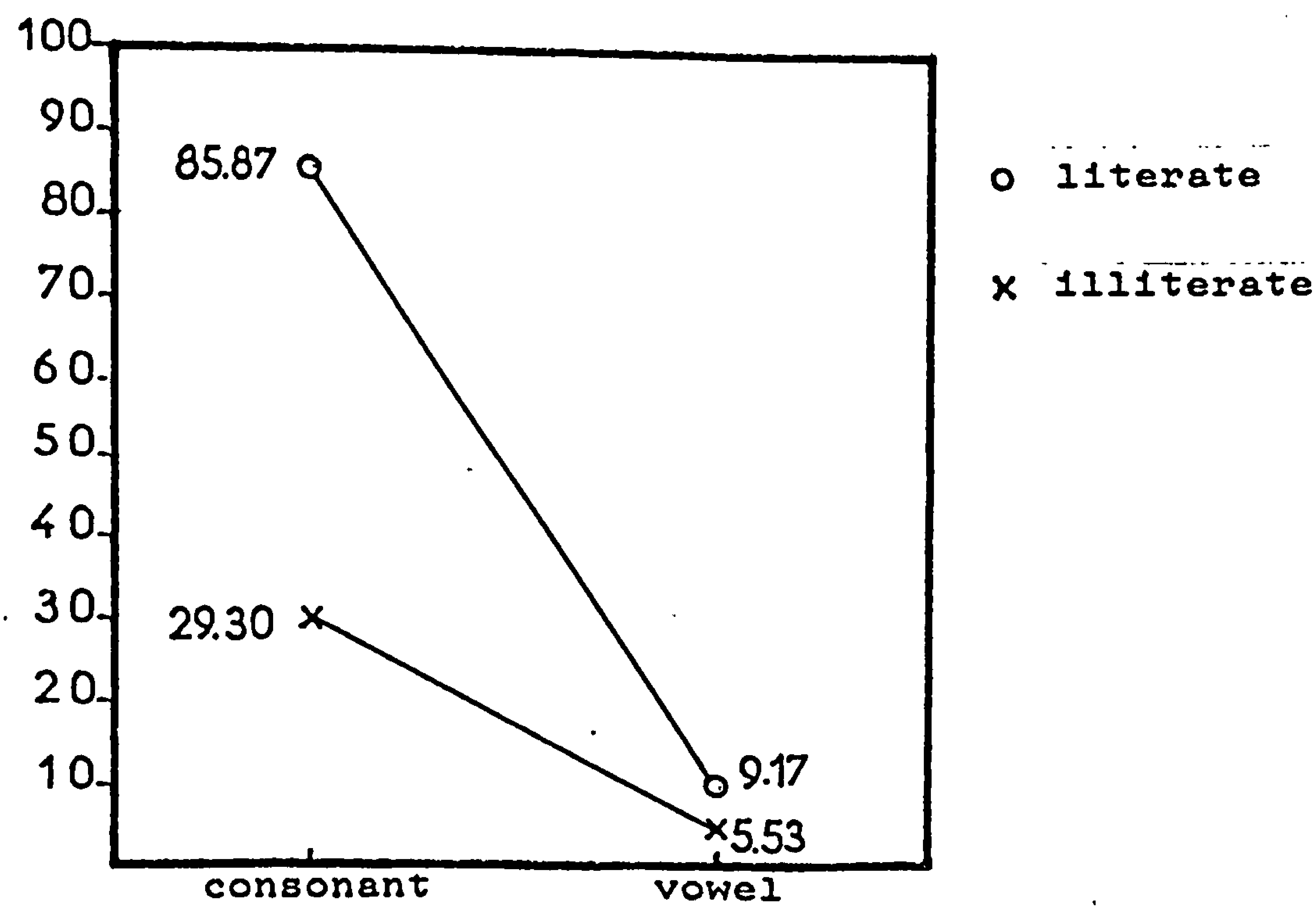
Means were 57.58% for consonants as compared to 7.35% for vowels. This difference was found to be highly reliable both by Ss (F_1 (1,112) = 477.16,p <.0001) and by materials (F_2 (1,32) = 108.75,p <.0001), min F' (1,48) = 88.56,p <.01. These results are summarized in Figure 6.6.C.

Results of the ANOVAS also indicated that while overall performance varied with whether the target segment was a consonant or a vowel, both age groups were sensitive to the same segment type. This is shown by the absence of an Age x Segment Type interaction (F_1 (1,112) = 0.29,n.s.) and (F_2 (1,32) = 1.05,n.s.). Means for children and adults were 50.14% and 65.03% for consonants and 1.07% vs 13.63% for vowels.

The Literacy x Segment Type interaction was, however, very reliable (F_1 (1,112) = 118.75,p <.0001); (F_2 (1,32) = 88.35,p <.0001); (min F' (1,114) = 8.7,p <.01). Means for literates and illiterates, respectively were 85.87% vs 29.30% for consonants and 9.17% vs 5.53% for



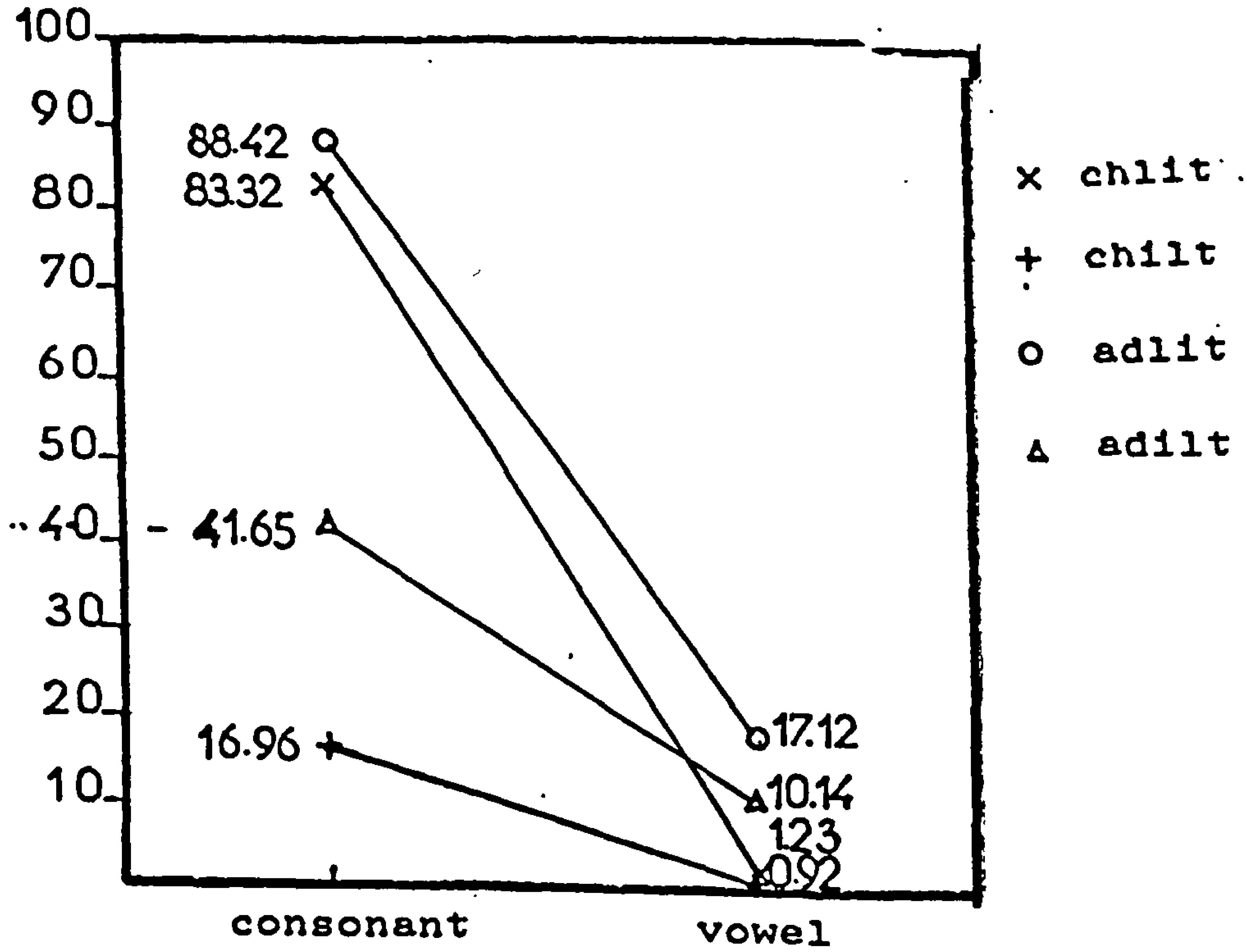
Experiment 6 - Fig. 6.6.C: Mean percentage correct responses as a function of the type of target segment



Experiment 6 - Fig. 6.6.D: Mean percentage correct responses as a function of literacy and segment type vowels. This result is graphically depicted in Figure 6.6.D.

The presence of this interaction was essentially caused by the fact that while the literates performed better than the illiterates when the target was a consonant ($\bar{X}$ = 85.87% for the literates as compared to 29.30% for the illiterates), both groups performed similarly when the target was a vowel ($\bar{X}$ = 9.17% and 5.53%, for the literates and the illiterates, respectively) (Scheffé tests at $p < .05$).

These results, were further qualified by a three-way Age x Literacy x Type interaction (F_1 (1,112) = 10.91, $p < .0001$); (F_2 (1,32) = 43.15, $p < .0001$); min F' (1,144) = 8.7, $p < .01$). This interaction appears to reflect the fact that the difficulty with vowel targets as compared to consonant targets was more marked in the literates ($\bar{X}$ = 85.87% for consonants vs 9.17% for vowels) than in the illiterates ($\bar{X}$ = 29.30% vs 5.53%, for consonants and vowels, respectively), and more pronounced in the literate children ($\bar{X}$ = 83.23% vs 1.23%) than the literate adults ($\bar{X}$ = 88.42% vs 17.12%). Conversely, in the illiterate group, Ss were more affected when they were adults ($\bar{X}$ = 41.65% vs 10.14%) than when they were children (16.96% vs 0.92%). Post-hoc Scheffé tests disclosed that whether the target was a consonant or a vowel determined the performance of all age and literacy groups except the illiterate children whose performance did not vary significantly with the type of segment. This can safely be attributed to a floor effect among the illiterate children. In fact, an inspection of the distribution of the scores indicate that of the 36 illiterate children, 27 (or 75%) failed to give any correct answer. The means in the three-way interaction are graphically depicted in Figure 6.6.E.



Experiment 6 - Fig. 6.6.E: Mean percentage correct responses as a function of age, literacy and segment type

In summary, the results have yielded a very strong effect of the target type. Irrespective of age or literacy, virtually all Ss failed to identify the target segment when it was a vowel.

In order to be able to compare results from the present experiment with those in Experiment 5 which considered only consonants, and since virtually all Ss failed to identify vowels, a reanalysis of the data was performed which excluded scores on vowel targets.

What emerged from this reanalysis of the data was that there was an increase in performance which confirmed that Ss were sensitive to final vowels. This helps to explain the low overall performance observed in the original analysis. However, the between-group scores remained substantially different with the literates out-performing the illiterates (compare Tables 6.6.2 and 6.6.4).

		LITERACY			
		Literate		Illiterate	
AGE	Child	83.32	(29.59)	16.96	(9.17)
	Adult	88.42	(30.34)	41.65	(17.81)

EXPERIMENT 6 - Table 6.6.4: Mean percentage of correct respones (excluding scores on vowel targets) as a function of age and literacy. Standard deviations are in parentheses.

Both Age and Literacy effects were found to be very reliable:

(F_1 (1,112) = 11.73%,p <.0009; F_2 (1,16) = 103.81,p <.0001; min F' (1,127) = 10.5) for Age and (F_1 (1,112) = 186.21,p <.0001; F_2 (1,16) = 108.82,p <.0001; min F' (1,38) = 68.68,p <.01) for literacy. Means were 65.03% vs 50.14% for adults and children, respectively, and 85.87% vs 29.3% for literates and illiterates, respectively.

The Age x Literacy interaction which was not found to be significant in the original analysis was, on this occasion, very reliable (F_1 (1,112) = 5.88,p <.01; F_2 (1,16) = 43.37,p <.0001; min F' (1,36) = 5.17,p <.01). This interaction suggests that while the literates performed far much better than the illiterates, the Age effect within the two illiterates was more marked (Scheffé p <.05) than that in the literates (Scheffé n.s.).

2.1.3 Effect of Context

In this section we examine the possibility that decisions on the final segment were dependent on the preceding context. It will be remembered from the design section that we were concerned with the degree of cohesiveness within consonant clusters when they form a coda as well as the degree of cohesiveness between a terminal consonant and the vowel immediately preceding it.

This analysis included only stimuli ending in a consonant (see section above). Means and standard deviations are shown in Table 6.6.5 below.

	CONTEXT			
	Consonant		Vowel	
CHLIT	95.14	(12.20)	77.30	(15.53)
CHILT	19.43	(35.63)	15.73	(25.24)
ADLIT	100.00	(00.00)	82.63	(9.31)
ADILT	51.38	(38.20	36.80	(25.88)

EXPERIMENT 6 - Table 6.6.5: Mean percentage of correct responses as a function of Age, Literacy and preceding Context (ie whether target segment is preceded by a consonant or a vowel).

The effect of context was found to be generalisable across Ss (F_1 (1,112) = 58.70,p <.0001) but not across materials (F_2 (1,14) = 1.77,ns). Means for preceding consonants and preceding vowels were 66.48% and 53.11%, respectively.

Two interactions were recorded. The first one, Age x Literacy, was very reliable (F_1 (1,112) = 8.12,p <.005; F_2 (1,14) = 51.54,p <.0001; min F' (1,125) = 7.01,p <.01)). The second one, Literacy x Context, was only marginally significant in the by-Ss analysis (F_1 (1,112) = 4.14,p <.04).

The advantage of targets preceded by a consonant indicates that final consonants are less cohesive to the other consonants in a cluster forming a coda than to the preceding vowel in a VC configuration. This tendency appears to confirm the findings from Experiment 5 which revealed that consonant clusters forming an onset were not cohesive. But Experminent 5, also showed that in CVC configuration CV was cohesive. How is this finding reconciliable with the finding from the present experiment that VC configurations tend to be cohesive?

There are, at least three reasons why this last result should be played down. Firstly, while the data from Experiment 5 indicated that there was a clear advantage for CC than for CV ($\bar{X}$ = 66.28% vs 35.17%), the data from the present experiment showed that there was only a slight advantage for CC over VC ($\bar{X}$ = 66.48% vs 53.11%; Min F' n.s). This difference, it will be recalled, was generalisable only to Ss, but not to materials. Secondly, the marginally significant literacy x context interaction, suggests that any difference between scores on CC and VC configurations, was (marginally) important only among the literates. Thirdly, and more importantly, it should be pointed out that of the 18 stimuli used in this experiment, only six were preceded by a consonant (ie CC configuration) and the remaining by a vowel (ie VC configuration) [15]. This could mean that the greater the number of VC configurations, the greater the number of errors.

In sum, our argument has been that the tendency for VC configurations to be more cohesive than CC sequences is very weak and therefore, its importance should be minimised.

2.1.4 Effect of Orthography

It will be recalled that some test items (viz /kita:bun/ and /qirdun/) were included in the stimulus materials to test directly the hypothesis that knowledge of orthography is used as part of the judgment strategy.

An analysis of the Ss' responses revealed that the relevant items did not produce more than six correct responses each out of a possible total of 120. Given the small number of correct responses, it is clear, that no legitimate general statistical analyses could be performed. But the point is clear: Ss failed to identify the final segment 95% of the time.

While the literates were successful with those items whose final segment is orthographically expressed by consonant symbols, they consistently identified the terminal phonetic sound in /qirdun/ and /kita:bun/ as /-dun/ and /-bun/, respectively. When they responded at all, the illiterates also gave similar responses for /qirdun/ and /kita:bun/, but as we argue further below, this was for quite different reasons.

The literates' responses clearly suggest that they did not use a phonetic cue. Nor did they adopt a syllabic strategy as it might appear from their responses. If the literate Ss were relying on a phonetic or syllabic strategy, all the items in this experiment should have been treated in the same manner. We know they were not. By reacting differently to stimuli sharing the same final segment phonetically, but having a different orthographic representation, Ss were simply relying on orthographic cues.

Recognizing this tendency when we were administering the test, we used other words as back up test items (eg /sabun/'soap', /ʔinsan/ 'human being, Man', /ʃukran/'thank you' [16]. Again, while those items whose final segment is represented orthographically by a consonantal symbol yielded correct responses, their control counterparts did not. We are forced to conclude that the literate Ss were influenced by their orthographic representation of the test words.

That this account is the correct one is further supported by Ss' verbal reports which revealed that spelling was used as part of the judgment strategy [17].

It does appear, then, that when phonetic similarity is accompanied by orthographic cohesion or identity, this similarity is attested; otherwise, it is not, even if it is quite transparent. Put another way, orthography may be facilitative in that it clarifies how speech is segmentable into segments. However, it can also inhibit accurate perceptions of similarly pronounced words when the spellings are different.

Another explanation, though not altogether unrelated to the one we have been considering, is to view orthography as a more efficient system for encoding and eliciting information about relatively abstract judgments, notably, the morphophonological relationships of the words in the language. It may be that prior to contact with conventional spelling, lexical items are perceived phonetically, but with experience of spelling there may be a shift towards a morphophonemic basis for judgments. Thus as the literates' knowledge of the morphophonological form of a word increases with literacy experience, they come to represent the word in a rather abstract form that is more closely related to the spelling than to the sound of a word. Furthermore, Chomsky (1970) suggests that the child's lexicon may be organised phonetically, and that with development it is reorganised to code the similarities in meanings of related words. For example, 'courage' and 'courageous' may be totally separate lexical entries for the child. While research is needed to substantiate these suggestions, some data on preliterate children's invented spellings provide some evidence. These findings (Read, 1973, 1975; Chomsky N., 1970; Chomsky C., 1970) suggest that preliterate children hear more phonetically, and only later (with more experience with literacy) are able to tap a deeper phonological level. In other words, having a writing system that corresponds to the underlying representations rather than to the particular surface phonetic structure of the words may help organise one's phonological knowledge.

As we observed above, there is no strong empirical evidence for such a view. In fact, Linell (1979) suggests that spellings generally deviate from the orthographic norm in the direction of a phonetically more accurate spelling (p 203). He further makes the suggestion that it is probable that "graphophonological rules are added to the phonology of the language as correspondence statements for relationships between phonemes and graphemes <u>without</u> being integrated into an overall expression component common to both speech and writing" (1979, p 203) [41]. Derwing (1973) also seems to reject the view that rules used in reading are similar to the 'abstract' morphophonological rules posited independently in a generative phonology. He makes the remark that English-speaking children have very great difficulties in learning the spelling of English which, according to Chomsky and Halle (1968, p 49) is "remarkably close" to underlying forms. In contrast, Russian children have minimal problems in learning Russian orthography which is relatively 'phonetic' and quite remote from the underlying forms (p 128).

While we seem to be cautious at favouring one explanation over another, we are more confident about the general issue. The present data clearly demonstrate that our literate <u>S</u>s' decisions are influenced by the orthographic structure of the language. At the same time, this experiment demonstrates that excluding this factor and its potential influence distorts - at least partially - the picture one gets about the metalinguistic knowledge of literates. For example, if we had not considered the orthographic factor, we would have been forced to conclude that literate <u>S</u>s are unable to identify the final segment when it is a nasal. We know that is not correct. Orthographic interference seems to be an important potential source of artifacts in phonological experiments involving literate <u>S</u>s.

Finally, if, as we have demonstrated, the literates were relying on a direct orthographic representation, what about the illiterates? As noted earlier, illiterate Ss also failed to give the final segment of such items as /qirdun/ and /kita:bun/. Indeed, like the literates, they also responded with /-dun/ and /-bun/. However, unlike the literates, they treated all the items in the same manner irrespective of their orthographic shape or the type of the final segment they had. Typically, when they did not respond with the words' "initial syllable" (eg /ki-/ for /kita:bun/), the illiterates responded with /-dun/ and /-bun/ for /qirdun/ and /kita:bun/, respectively, and they also responded with /-ra/ for /kura/, /fəz/ for /qfəz/, /-bun/ for /sabun/. These findings can therefore be viewed as an outcome of the illiterates' difficulties of phonological segmentation. At the same time, they provide more supportive evidence to our interpretation that the literates adopted an orthographic strategy.

To summarize this section, by manipulating the stimulus materials utilized in the present experiment, we have been able to isolate the effect of orthography on the literate Ss' awareness of the segment. As predicted, we have found that literacy does promote linguistic awareness as when it facilitates identification of those segments which are represented orthographically; at the same time, it can also distort the literates' phonetic intuitions by making them 'deaf' to certain phonetic realitites that are not normally expressed in the script or, if they are, are not represented by consonant symbols but by diacritical marks. Diacritical marks do not seem to be represented in whatever visual-spatial model of speech is derived from the orthography of the language.

D. Summary, Implications and Conclusions

The major results from the present experiment clearly indicate that the two literacy groups are fundamentally different. Irrespective of age, the literates were by far better able to identify final segments than the illiterates who performed rather poorly.

This experiment has also demonstrated that overall, performance appears to be dependent on the linguistic variables manipulated in the stimulus materials. First, although the literates were more successful in identifying final consonants than the illiterates both literacy groups failed to extract vowels. Second, knowledge of orthography appeared to participate in the literates' judgment strategy. Not only did the literate Ss fail to detect the vowels (which, it will be recalled, are normally omitted in print), but their performance also varied with whether or not terminal consonants are represented in the orthography, with a very high rate of success for those that are expressed by a consonant-letter and a complete failure for those that are not.

In what follows, we consider some implications of these findings for metalinguistic awareness and for some other related research areas. More specifically, our discussion will focus on (i) why consonants were found to be more available than vowels, and (ii) the role of orthography in shaping the literates' organisation of the sound system of the language.

As mentioned earlier, the evidence from the present experiment that Ss were more aware of consonants than vowels simply supports our hypothesis that the phonological and orthographic differences that may exist between vowels and consonants should be reflected in the differences at the level of metalinguistic awareness. In particular, these results are compatible with what is perhaps the best known fact of semitic languages, namely, that consonants and vowels are functionally different. Consonants commonly carry lexical information in a word, whereas the grammatical information is carried by the vowels. Realisations of the same root in combination with different derivational morpheme patterns usually cluster around a single semantic field. In Arabic, for example, there is a clear sense in which /darasa/ which is the active form for 'study', /durisa/ the passive form 'was studied', / dars / 'lesson', / da:ris / 'one who studies', / mudarris / 'teacher', / mada:ris / 'schools' are morphologically related to one another. In other words /d-r-s/ represents the consonantal root 'study' whereas, for example, /-a-a-/ and /-u-i-/ render the grammatical functions which yield the active and passive forms, respectively [18]. Although no research has been undertaken to investigate the psychological reality of the root (or root - plus pattern combination), speakers' awareness of the root-meaning correlation in Semitic languages does manifest itself in their linguistic creativity (eg their ability to coin new lexical items) as well as their ability to interpret unfamiliar words. A further discussion of this issue is to be found in connection with Experiment 7.

Our findings also have implications for the orthographic system of

Arabic which appears to agree with the idea that consonants are semantically more 'salient' than vowels. As we saw earlier, in this system, consonants are the only markers of words. Short vowels, on the other hand, are expressed (when they are at all represented) by small graphic symbols that are appended to the consonants, but cannot stand by themselves. They need a carrier. Since vowels are normally omitted from the script, it is left to the native competence of the reader to interpret the predictable phonological realisations; the meaning, however, is recovered from the consonants which distinguish the root forms.

Historically, consonants played such vital roles in the development of syllabic writing systems, perhaps because they are informationally more important than vowels; especially in the Semitic languages. According to Diringer (1963), the North Semitic writing system of the second millenium BC is considered to be the first alphabet which abstracted and represented consonants adequately. As for the absence of vowels (in early Semitic writing), no satisfactory explanation has been offered. Diringer treats this phenomenon as inexplicable. A recent study by Sampson (1985), however, seems to provide an explication. According to Sampson, if we assume that the Semites created their graphs by the acrophonic principle, then we are able to explain why the script does not provide graphs for vowels [19]. "... all words in Semitic languages begin with consonants, so that if letters are invented acrophonically there is no possibility of getting letters for vowels ..." (1985, p 82).

We shall return to this issue in the General Discussion section at the end of this chapter when we deal with the relationship between awareness of segments and the invention of the alphabet. Suffice it so say, for the present, that the discovery of vowel letters which form the basis of the analytical principle of an alphabetic system, can be characterized as something of an accident rather than a conscious insight.

The present data also help to explain why short vowels seem never to have been thought of in the same way as consonants and prolonged vowels by early Arab grammarians and phoneticians. For example, while consonants have well-defined discussions in the works of the early Arab phoneticians, most of the information about vowels has to be gleaned from casual references (see Al-Ani and May 1978). In light of our findings, this practice is not surprising. As was previously mentioned, long vowels are expressed by consonant graphemes (which do double duty by serving as full consonant-letters and by indicating long vowels). This appears to be the chief reason why they tend to be treated in the same way as consonants. Short vowels, on the other hand, are not normally marked in the print and, therefore, will tend not to be thought of in the same category as long vowels or even noticed. The linguists' familiarity with a particular writing system and a particular way of transcribing language influences preconceptions about how certain linguistic units should be treated.

That written representations can powerfully influence the linguist's analysis of segments is also suggested with respect to

English by Ehri et al, (1980) and Skousen, (1982). Skousen, for example, argues that it is not inconceivable that some of the phonetic and phonemic analyses of speech proposed by linguists arise solely from orthographic considerations. Without these concerns, it might be unnecesary to decide whether the alveolar flap in words such as 'rider' and 'writer' is to be interpreted as /t/ or /d/, or less desirable to regard the nasal in such words as 'blink' and 'bump' as a separate phoneme rather than a nasalised vowel.

Our findings regarding the impact of orthography on linguistic awareness, also seem to be largely compatible with some evidence from other psycholinguistic research, in particular, with recent research on word recognition and lexical access. In what follows, we will consider some of this research in light of our results.

Current models of word recognition such as Morton's (1969, 1979) Logogen model [20] and Spreading Activation model of Collins and Loftus (1975) assume that orthographic information is contained in Semantic memory (see also Marshall, 1976). This assumption was verified in a recent study by Seidenberg and Tanenhaus (1979) which demonstrated that the orthographic code is readily available in a word recognition task. This study used a rhyme-monitoring task: listeners monitored lists of spoken words for one that rhymed with a given stimulus word (eg clue). The targets were either orthographically similar (eg glue) or different (shoe) from the given word. Latencies were shorter for orthographically similar rhymes.

Recently, Jakimik, Cole and Rudnicky (1980) investigated the impact of orthography in a lexical decision task. In this study, adult Ss heard a list of spoken words and nonwords and were requireed to indicate whether each was a real word by pressing a buzzer. In some cases, the words presented shared the same first syllable and spelling (eg napkin, nap). In other cases, words shared the same first syllable but were spelled differently (laundry, lawn). Included in the list, were control words to determine whether similarities in spelling or sound or both would facilitate recognition of the second word. RTS were shorter when the words had similar spellings than when they were similar phonologically but different orthographically.

In a more recent study, the same authors (Jakimik et al, 1985) conducted several experiments where they showed that lexical decisions about spoken words were influenced by the spelling of an immediately preceding item. Specifically, lexical decisions to one-syllable words were faster when part of the preceding word shared both the same sound and spelling. Thus, a lexical decision for 'mess' was faster following 'message' than following 'letter'. Facilitation was not observed when words were related by spelling alone (eg legislate - leg). Interestingly, orthographic facilitation occurred for both words and nonwords (eg regular - reg).

Our findings can also be shown to have implications for research in visual word recognition. One of the basic questions in reading research is whether access to the lexical entry of a printed word is mediated by its phonological representation. According to one position

(Rubenstein, et al, 1971) a visually presented word is first transcoded into a phonological code before its meaning can be retrieved. A second position is that semantic information may be retrieved directly from the graphemic representation of a word (Smith, 1971). A third view is that both routes to the lexicon are available and may be used either interchangeably or in parallel.

There is some agreement that readers of English access the mental lexical entries by means of independent phonemic and graphemic codes. The choice is governed by several factors. Of these factors is the type of reader (eg beginners tend to use the phonemic code more than skilled readers) and the type of word to be accessed (eg high frequency words and more likely to be accessed via a graphemic route). In view of our findings, and in agreement with Bentin and Bargai (1984), the type of writing system which represents the phonology of the language should also be considered as another factor that may influence a reader's decision to choose either one of the two access routes, namely, the graphemic and the phonemic routes.

From our findings, it would be expected that for a language like Arabic whose orthography is phonologically dubious because it does not normally represent vowels, mental lexical entries would be accessed via the graphemic code. There is at least some indication that this hypothesis is a plausible one. A recent study was conducted by Bentin and Bargai (1984) which concerned the effect of the phonemic mediation for lexical access when printed Hebrew words are presented in isolation. Hebrew, like Arabic, has two forms of spelling, "pointed" (or vowelised) and "unpointed" (or unvowelised). Vowels are represented by small dots appended to the consonants. Again, as in Arabic, these diacritical marks are almost always omitted. Taken together, the findings from the experiments used in the Bentin and Bargai's study speak to the fact that the orthographic code appears to be a more dominant code in the process of visual word recognition than the phonemic code, especially in comparison with the role it plays in some of the Indo-European languages. One of these experiments (Experiment 3) was found to provide some converging evidence. Nonwords (eg /aven/) that resembled real words (eg /even/ 'stole') orthographically were more difficult to reject than nonwords that resembled real words phonemically. The implication here is that rejection of the orthographically similar nonwords was more difficult because they more closely resembled the information in the lexical representation.

Another recent study, also involving Hebrew (Koriat, 1984), found that "pointing" has almost no effect on the lexical access of visually presented words. Again, this finding is interpretable as indicating that the mental lexicon is not phonologically mediated. This study and the one discussed earlier are an important step toward defining the theoretical relationships between different writing systems and the languages they represent. Furthermore, by examining the factors that affect word recognition in different writing systems, we should be in a better position to characterize the nature of certain information processing strategies that users of different scripts may have developed.

Finally, to the extent that they have clearly demonstrated that orthographic interference is an important potential source of artifact that should be controlled for, our findings have important methodological implications for psycholinguistic research that uses literate Ss (ie most psycholinguistic research). For example, in the case of the phoneme monitoring experimental paradigm which requires Ss to listen for a given sound segment and respond to it, literate listeners may monitor for the speech sound target by referring to the spelling of the sound. In that case, the letter (and not the sound) will be the unit identified. We would for example, expect silent letters and sounds which are phonetically similar but orthographically different to cause false alarms and yield longer latencies than target sounds which are unambiguously represented by the orthographic system. Future research can test these predicitions. It also remains for future research to ascertain more fully differences between literate and illiterate Ss in phoneme monitoring tasks. In particular, because they are unable to represent speech in terms of segments, illiterate adults will not understand what is required of them in tasks like ours. In other words, if these experimental tasks are popular among students of speech (and perhaps among their literate Ss), they may not be so among their illiterate Ss.

To conclude, in the past, studies which investigated the relationship between oral and written language were largely concerned with exploring the influence of speech on writing. This is based on the assumption that speech is the sole source of data for linguistic research and that writing is a representation of speech. One of the main aims of the present experiment was to investigate the influence of writing on the awareness of speech segments. It now appears that the prevailing view that speech is the privileged mental code for language is not well-founded, and at best, odd. For to say that is to say that our linguistic knowledge remains unaffected by the process of our becoming literate. In light of our findings, awareness of segments seems to rest on the conventions of the writing system. Writing itself appears to exert a tremendous influence on our mental representation of speech. We would even go so far as to suggest that knowledge of writing pervades <u>natural</u> speech perception [21]. Part of the final Chapter of the present study will be devoted to investigating the nature of the relationship between knowledge of writing and speech. The view taken there is that the assumption that writing is speech recorded and that language is speech is not well motivated. In a sense what is at issue is the definition of language. We shall suggest that linguists will do well to recognise that orthography ought to be part of the theory.

V Experiment 7

A. Introduction

The purpose of this experiment was basically similar to that in Experiment 4 in which <u>Ss</u> were required to resequence syllables. The present experiment assesses the <u>Ss</u>' ability to manipulate segments by either scrambling the consonants or vowels of a word (PRODUCTION TASK) or restoring the normal segment sequence of a scrambled word (RECOGNITION TASK).

It was expected that Arabic would provide an ideal test here. As we saw in the discussion of Experiment 6, this language is characterised by words (mainly content words) formed from a consonantal root, signalling semantic class - and different patterns of interdigitated vowels - representing grammatical inflections, or form class [22].

There has been little research on the psychological reality of the root-plus-pattern combination for speakers of Semitic languages (but see suggestions in Berman, 1981, 1982; Clark and Berman, 1984, for Hebrew). Yet, given that the consonants form the basic skeleton which signals the meaning of a word, and that the vowels (which are not part of the root) only represent different grammatical inflections in the canonical shape of a word, it is reasonable to assume that Ss would be more aware of, and hence, better able to manipulate consonants than vowels in the knock-knock resequencing game.

Another argument for making this prediction comes from a language game of Bedouin Hijazi Arabic reported in McCarthy (1981) and Al-Mozaini (1981) and already cited in Chapter 4. In this game, the consonants of the root may be freely rearranged into any order though non-root consonants and the canonical pattern of the form remain unchanged. For example, the possible permutations of /difaʕna/ 'we pushed' (Root DFʕ) are as follows:

(a) daʕafna

(b) fidaʕna

(c) faʕadna

(d) ʕadafna

(e) ʕafadna

Apparently, these permutations can be both performed and decoded with some fluency [23].

Some observational evidence which suggest that consonantal roots may be available for 'extraction', comes from research in the acquisition of another Semitic language, namely, Hebrew. Berman (1982) claims that children acquiring Hebrew can in fact 'extract' consonantal root elements for purposes of constituting and interpresting novel verbs and nouns. Recently, Clark and Berman (1984) have suggested that children acquiring Semitic languages "must learn to analyse unfamiliar words in terms of their consonantal structures" (p 584). They further note that even at a very young age, the children they studied had little difficulty extracting some kind of consonantal skeleton in interpreting unfamiliar words. A more abstract appreciation or recognition of consonantal elements, however, seem to be achieved in school age children only, possibly, as Clark and Berman suggest, "as a result of their growing knowledge of orthography" (p 585).

Following Berman (1982) and Clark and Berman (1984), it would appear that metalinguistic conceptualisation of the crucial Semitic notion of the consonantal root as the semantic core of words, on the one hand, and the knowledge of the special interrelation between the consonantal roots and the pattern systems, on the other hand, "depend to some extent on the establishment of literacy, as well as a certain amount of formal tuition at school" (1982, p 185). It would seem, then, that schooling in general and literacy in particular, promote and facilitate appreciation of the internal structure of words in a Semitic language.

B. <u>Method</u>

1. <u>Tasks</u>

As mentioned earlier, the present experiment employed both a recognition (REC) and a production (PRO) task. In the REC task, <u>S</u>s were presented with scrambled words and were required to restore their normal segment sequencing. Thus, input /ramis/ yields the word /samir/.

In the PRO task, the operation was reversed: <u>S</u>s were presented with meaningful words and were required to alter their normal sequencing by scrambling their segments. Each one of the two tasks had two conditions: consonants and vowels. Details regarding the procedure are given further below.

2. Materials and Design

Four sets of eight real words each were constructed and constituted the basis for stimuli in both tasks. In order to make the reversed words and the real words of comparable difficulty, stimuli with reversed consonants and vowels for sets A and B, C and D (ie REC task) were derived from real words in sets B and A and D and C, respectively (PRO task). Each S received two lists for consonants (one PRO and one REC) and two lists for vowels (one PRO and one REC). Full lists are found in Appendix F.

The materials were designed as follows:

(i) Each set contained bi- and triconsonantal stimuli. This design allowed effects of length as measured by the number of consonants to be assessed (LENGTH FACTOR).

(ii) Each set in the consonant REC task contained the following sequencing:

C2 C1 (3 items) C2 C1 C3 (3 items) and C3 C2 C1 (2 items):
(ORDERING FACTOR)
We hypothesised that different orders in the constitutive consonants of a test item would affect performance.

We further predicted that consonant condition would be easier than vowel condition in both REC and PRO tasks. This predicition was based on (i) results from Experiment 6 which indicated that Ss were more aware of consonants than vowels; (ii) results from Experiment 4 (syllable resequencing) which revealed that performance was better when the input stimulus retained the same vocalic melody as the target than when this melody was disrupted, and (iii) research from other areas (some of which was reviewed in Experiment 6) which indicates that vowels are resistant to permutations.

3. Procedure

The procedure was similar to the one employed in Experiment 4 with the exception that Ss were required to manipulate segments rather than syllables. Thus, both REC and PRO tasks employed a version of the knock-knock game technique. For the present experiment, the rule for playing the game consists of either interchanging the segments of a non-word (REC task) to yield a real word (ie the target word to be identified) or altering the normal sequencing of a real word by scrambling its segments (PRO task).

The two tasks were always tested in the same session with the REC task always preceding the PRO task. In both tasks, the consonant condition always preceded the vowel condition.

C. Results and Discussion

We shall discuss, first, the results of the REC task, and then the results of the PRO task. Finally, we shall compare the two measures and examine some of the trends observed.

1. Recognition Task

Subject Variables

Scoring Data

The scoring principle was similar to that in Experiment 4. A response was scored when the target word was identified (ie when the reversed input word was restored to its normal consonant or vowel sequencing). Only one correct combination was possible.

1.1.2 Analysis and Findings

1.1.2.1 Consonant Condition

Means and standard deviations for the number of correct items are displayed in Table 6.7.1 below.

		LITERACY			
		Literate		Illiterate	
AGE	Child	59.84	(31.57)	21.09	(15.75)
	Adult	76.04	(18.06)	29.16	(32.19)

EXPERIMENT 7 - Table 6.7.1: Mean percentage of correct responses as a function of age and literacy. Standard deviations are in parentheses.

1.1.2.1.1 ANOVA

The pattern of results here was not markedly different from that observed in Experiment 4 (ie syllable resequencing). Thus, overall, adults were more successful than children (F_1 (1,91) = 7.02,p <.0009; F_2 (1,28) = 30.08,p <.001; min F' (1,118) = 5.89,p <.05) [24]. Means were 40.46% and 52.16% for the children and adults, respectively. Closer examination revealed that it was the literate adults ($\bar{X}$ = 76.04%) who increased the grand mean for the adult group; otherwise, the literate children performed significantly better ($\bar{X}$ = 59.84%) than both groups of illitreates who did not differ ($\bar{X}$ = 21.09% vs 29.16% for the children and the adults, respectively). This result is graphically depicted in Figure 6.7.A.

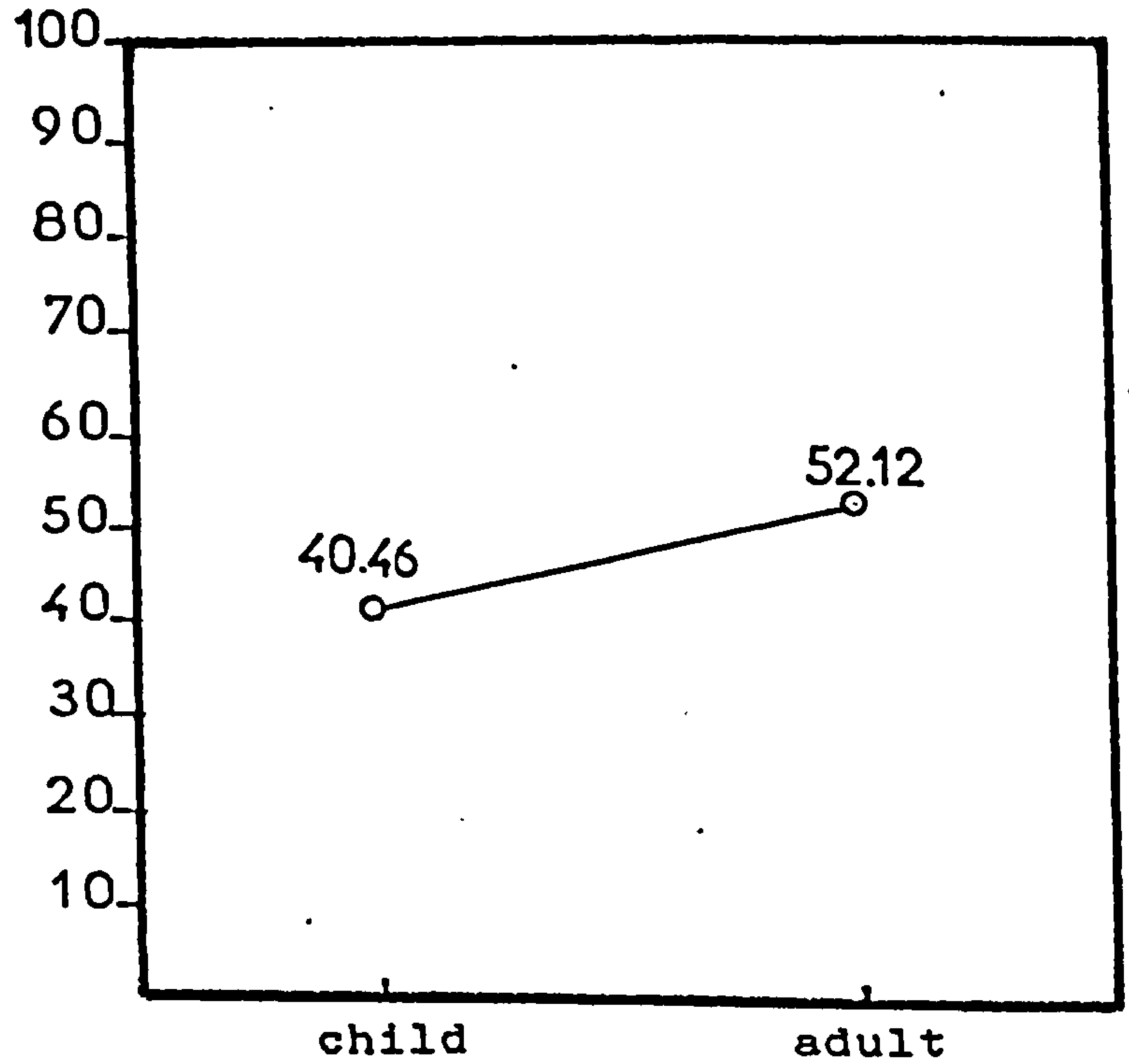
The effect of literacy was by far the stronger of the two main effects. Producing very large F ratios, it accounted for much of the variance both by Ss (F_1 (1,91) = 71.01,p <.0001) and by materials (F_2 (1,28) = 276.63,p <.0001); (min F' (1,19) = 61.49,p <.01). Means were 67.94% and 25.12% for the literates and the illiterates, respectively. Figure 6.7.B plots the literacy effect.

As in Experiment 4, the interaction between the effects of Age and Literacy was not found to be reliable by Ss (F_1 (1,91) = 0.82,n.s.) and only marginally so by stimuli (F_2 (1,28) = 4.03,p <.054). Although only of marginal significance, the Age x Literacy interaction is interesting. It appears to suggest that the literacy effect was more marked in the adult Ss than in the child Ss and that the Age effect, on the other hand, was more marked in the literate Ss than in the illiterate Ss. This can be safely attributed to the literate adults' superior performance. Indeed, an examination of the score distribution revealed 12 literate adults (or 50%) scored above 80% with five scoring at ceiling.

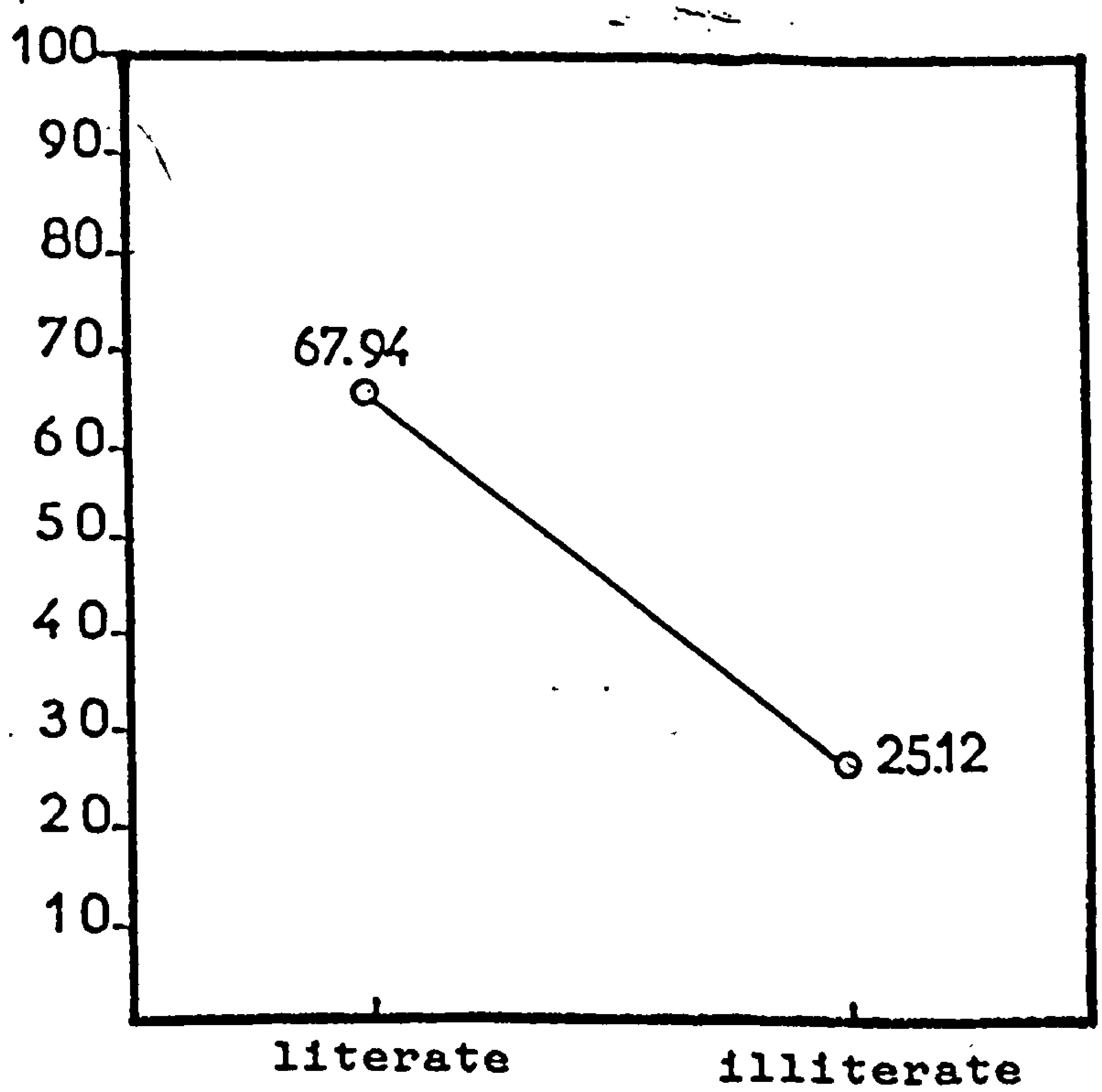
1.1.2.1.2 Correlation Tests

Correlation tests carried out on the child data revealed there was a significant association between Literacy level and Task score (r = 0.68,p <.01) as well as a smaller but significant correlation between Age and Task score (r = 0.44,p <.01).

When, however, literacy as measured by Grade was controlled for in



Experiment 7 - Fig. 6.7.A: Mean percentage correct responses as a function of age (Recognition task, Consonant condition)



Experiment 7 - Fig. 6.7.B: Mean percentage correct responses as a function of literacy (Recognition task, Consonant condition) the correlation (ie Age x Task . Grade), the result yielded a negligible partial correlation with Age ($r = 0.05$). On the other hand, when Age was held constant (ie Grade x Task . Age), the Literacy x Task correlation continued to be substantial ($r = 0.58$).

Tests on the data from the literate children only, yielded a modest but significant Age x Task score ($r = 0.32, p < .05$) and a fairly substantial literacy level (Grade 1 vs Grade 2) x Task score ($r = 0.53$). When Grade was held constant, the first correlation dropped to a negligible level (r Age x Task . Grade = 0.005). In contrast, the Grade x Task correlation was much less affected when Age was controlled for (r Grade x Task . Age = 0.39). Means were 75% and 43.75% for Grade 2 and Grade 1, respectively. The mean difference was found to be significant (F_1 $(1,31) = 12.66, p < .001$). Interestingly, the second graders' overall mean is virtually identical to that obtained by the literate adults (75% vs 76.04%).

In sum, unlike Experiments 3, 4, 5 and 6, the results of the present experiment indicate that strong correlation between level of literacy and performance which was obtained for all children cannot be attributed solely to the difference between the literate and illiterate <u>Ss</u>, but also partly accounted for by the difference in the <u>degree</u> of literacy among the literate children themselves. As already sugggested in our discussion of Experiment 4, it may be that for this type of task, one year of literacy (in the graphological sense) may not be enough, and that more schooling and formal tuition in general seem to provide the child with a more powerful notation system for organising information as well as a sepcific strategy which can be transferred and adapted to different situations. That our interpretation is plausible is confirmed by the results yielded by the ANOVA. These, it will be remembered, disclosed that the age effect was more marked in the literate Ss than in the illiterate Ss. This was attributed to the literate adult's superior performance.

1.1.2.1.3 Linguistic Variables

The design of the present experiment predicted that performance would vary (i) with the number of consonants in each stimulus (Length Factor) and (ii) with the order in which consonants were scrambled (Ordering Factor).

1.1.2.1.3.1 Effect of Length

A 4-factor ANOVA 2(Age (child, adult)) x 2(Literacy (literate, illiterate)) x 4(group (A, B, C, D)) x 2(Length (2 consonants, 3 consonants)) was performed over Ss and over materials.

As in the previous analyses, results by the ANOVA also revealed an effect of age (F_1 (1,91) = 7.02,p <.001; F_2 (1,24) = 29.06,p <.001) and an effect of literacy (F_1 (1,91) = 79.08,p <.001; F_2 (1,24) = 228.7,p <.001).

The effect of word length was not found to be reliable. In fact, it did not even reach an F of 1 in either analysis. Similarly, no interaction of Length with either Age or Literacy was recorded.

As detailed in Table 6.7.2 below, performance was no better when stimuli contained two consonants ($\bar{X}$ = 42.79%) than when it contained three consonants ($\bar{X}$ = 47.41%).

	LENGTH			
	biconsonantal		triconsonantal	
CHLIT	55.69	(10.10)	60.86	(21.04)
CHILT	13.53	(10.79)	22.76	(21.28)
ADLIT	78.20	(17.11)	75.92	(16.70)
ADILT	23.74	(18.21)	30.12	(20.65)

EXPERIMENT 7 - Table 6.7.2: Mean percentage correct responses as a function of Age, Literacy and Length of stimuli (ie whether stimuli were biconsonantal or triconsonantal). Standard deviations are in parentheses.

Although it does not feature in the experimental design, the number of syllables comprising a stimulus was also examined, but was not found to be reliable. However, there was a tendency for Ss to be more successful when stimuli were bisyllabic ($\bar{X}$ = 50.1%) than when they were trisyllabic ($\bar{X}$ = 40.90%) or monosyllabic ($\bar{X}$ = 38.80%). Table 6.7.3 gives the means and standard deviations for this length factor.

	LENGTH		
	Monosyllabic	Bisyllabic	Trisyllabic
CHLIT	50.95	63.00	57.01
CHILT	14.45	22.50	18.40
ADLIT	73.56	78.70	73.20
ADILT	16.25	36.20	15.00

EXPERIMENT 7 - Table 6.7.3: Mean score percentages as a function of Age, Literacy and length of stimuli (ie whether stimuli contained one, two or three syllables).

1.1.2.1.3.2 Effect of Order of Consonants

The expected effect of the Order in which scrambled consonants were presented was not found to be significant F >1. No interactions were recorded. (Table 6.7.4 below shows the means and standard deviations.)

	ORDER OF SCRAMBLED CONSONANTS					
	C2 C1		C2 C1 C3		C3 C2 C1	
CHLIT	55.69	(10.10)	61.12	(20.84)	61.88	(18.77)
CHILT	13.53	(17.79)	26.03	(20.31)	19.02	(11.18)
ADLIT	78.20	(17.11)	75.56	(18.43)	78.03	(20.11)
ADILT	23.74	(18.21)	30.10	(18.58)	32.50	(11.72)

EXPERIMENT 7 - Table 6.7.4: Mean percentage correct responses as a function of Age, Literacy and the order of scrambled consonants. Standard deviations are in parentheses.

Contrary to expectation, then, identification of the target word did not, in any significant way, depend on the ordering of the scrambled consonants in the input of stimulus. Overall, Ss were no more able to identify the target when the input was C2 C1 ($\bar{X}$ = 42.79%) than when it was C2 C1 C3 ($\bar{X}$ = 48.2%) or C3 C2 C1 ($\bar{X}$ = 47.85%).

This finding is interpretable as indicating that so long as the canonical shape of the word-form as represented by the vowel melody is maintained (ie vowels are not scrambled), root consonants may be freely permuted without causing too much of a problem for decoding - at least for the literates.

In that sense, the finding is compatible with the observation that in the Hijazi Arabic linguistic game discussed earlier wherein root consonants may be permuted into any order, non-root consonants and the canonical pattern remain unchanged.

1.1.2.2 Vowel Condition

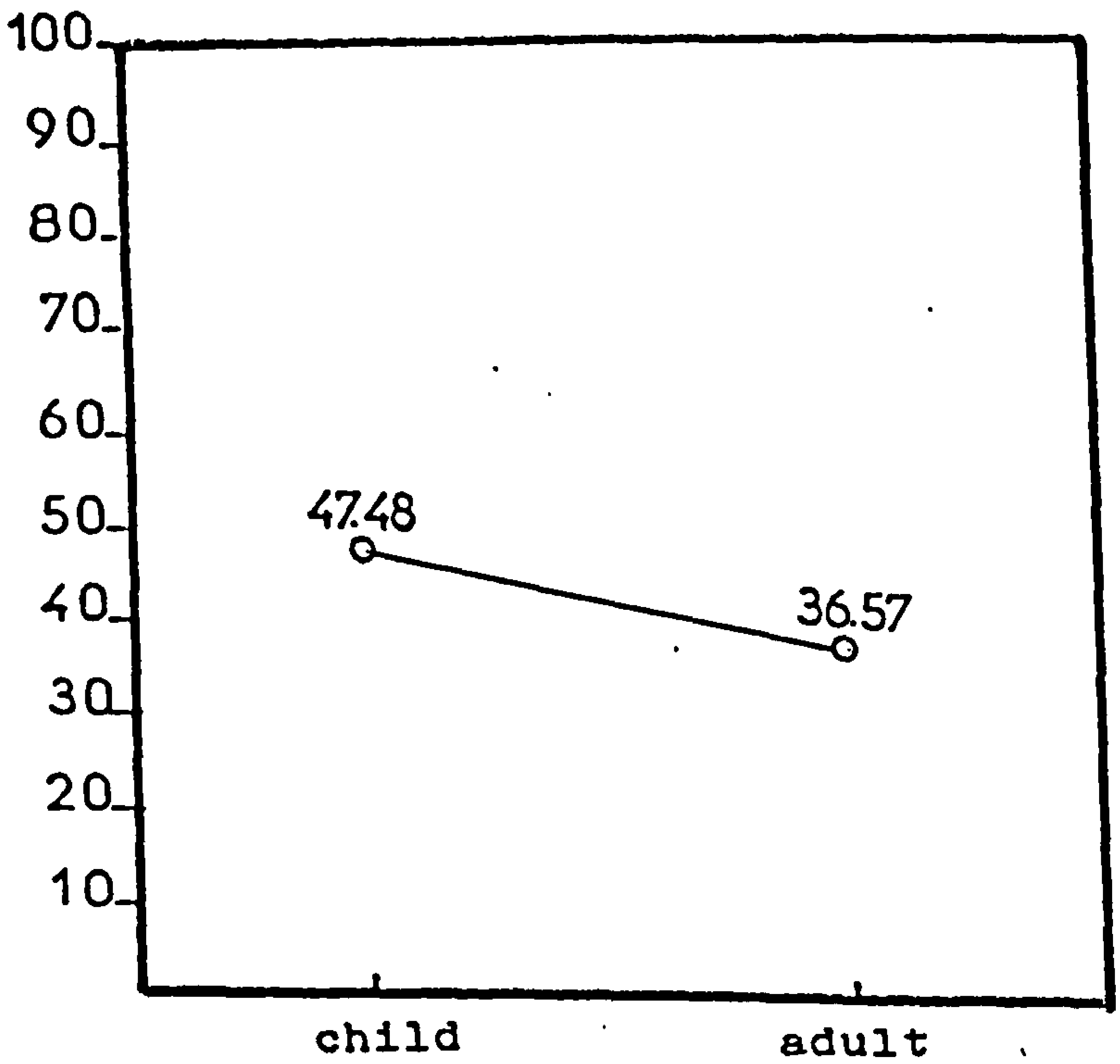
Means and standard deviations for the correct items identified are displayed in Table 6.7.5.

		LITERACY			
		Literate		Illiterate	
AGE	Child	53.93	(20.36)	19.21	(18.22)
	Adult	67.81	(11.78)	27.15	(26.88)

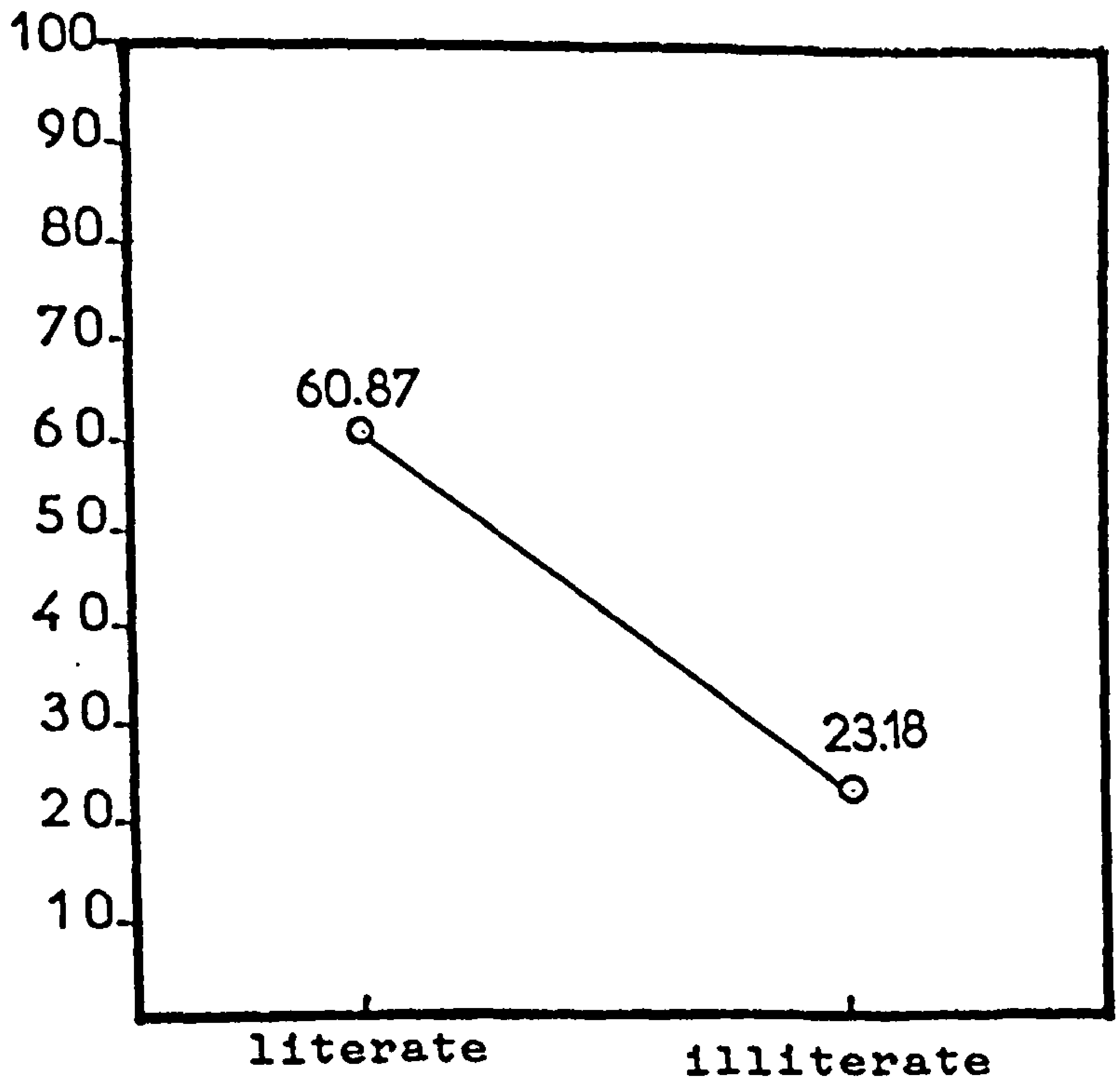
EXPERIMENT 7 - Table 6.7.5: Mean percentage of correct responses as a function of Age and Literacy. Standard deviations are in parentheses.

The pattern of results here was not markedly different from that observed in the consonant conditions (compare Tables 6.7.5 and 6.7.1). Thus, overall, the adults were more successful than the children (F_1 $(1,91) = 6.56, p < .01$; F_2 $(1,28) = 7.69, p < .009$; min F' $(1,94) = 3.53, p < .05$) and the literates more successful than the illiterates (F_1 $(1,91) = 77.62, p < .001$; F_2 $(1,28) = 120.34, p < .001$; min F' $(1,105) = 47.18, p < .01$). These results are displayed in Figure 6.7.C and 6.7.D. No Age x Literacy interaction was recorded.

A closer inspection of the results, however, reveals that the significant Age effect that was obtained masks an important finding: the literate children performed much better ($\bar{X} = 53.93\%$) than either one of the two illiterate groups ($\bar{X} = 19.21\%$ for the children and 27.15% for the adults). Age seems to be an important factor only when it also correlates with markedly increased literacy. Moreover, the difference between the two literacy groups ($\bar{X} = 60.87\%$ vs 23.18% for the literate and the illiterate, respectively) is more impressive than that between



Experiment 7 - Fig. 6.7.C: Mean percentage correct responses as a function of age (Recognition task, Vowel condition)



Experiment 7 - Fig. 6.7.D: Mean percentage correct responses as a function of literacy (Recognition task, Vowel condition) the two age groups ($\bar{X}$ = 47.48% vs 36.57% for adults and children, respectively).

2. Production Task

The procedure and method for scoring as well as the statistical analyses employed were similar to those in the REC condition. It will be remembered that no particular combination of segments was required. That is, Ss could permute consonants or vowels into any order they chose.

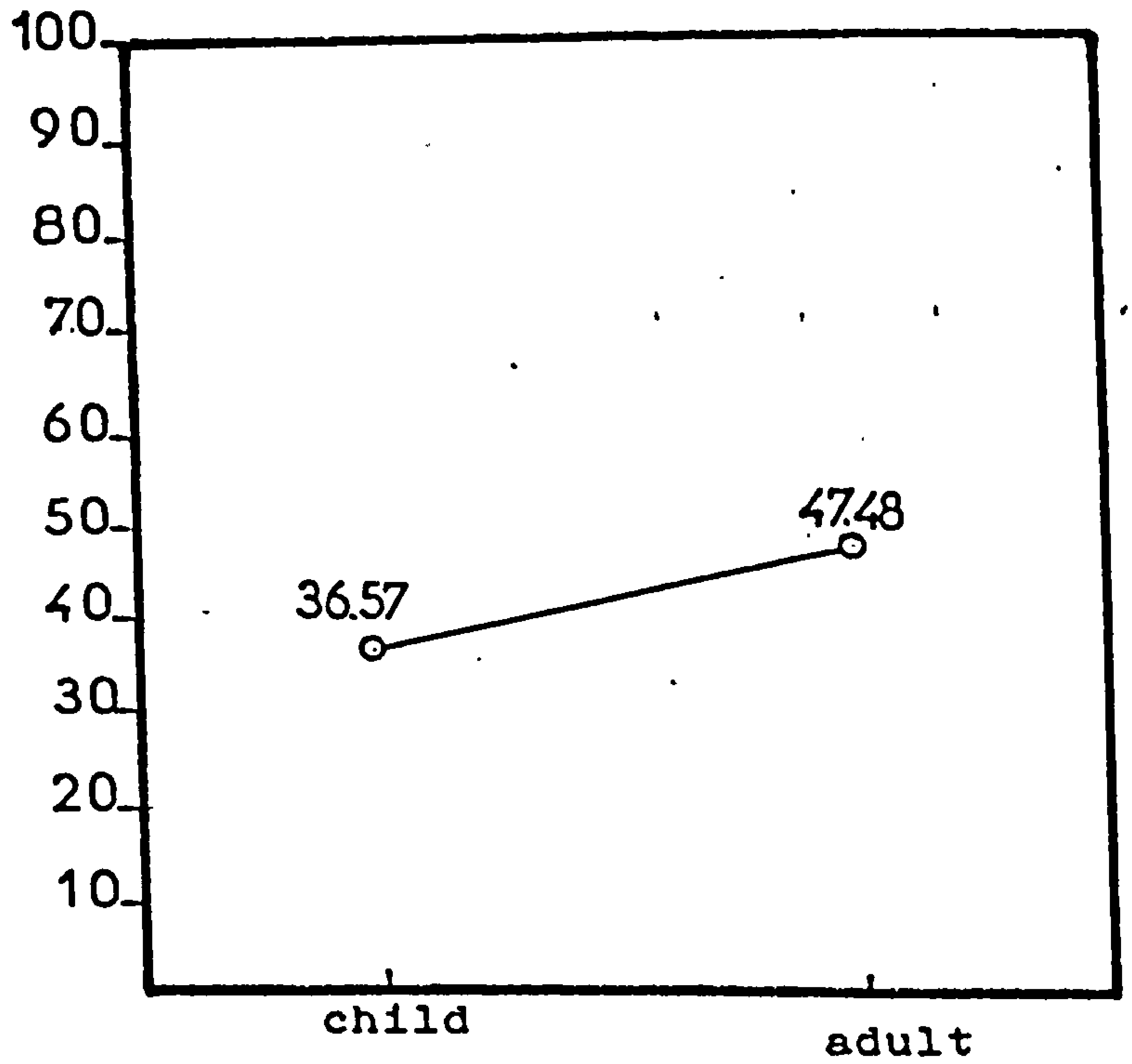
2.1 Consonant Condition

Means and standard deviations for the consonant condition are described in Table 6.7.6.

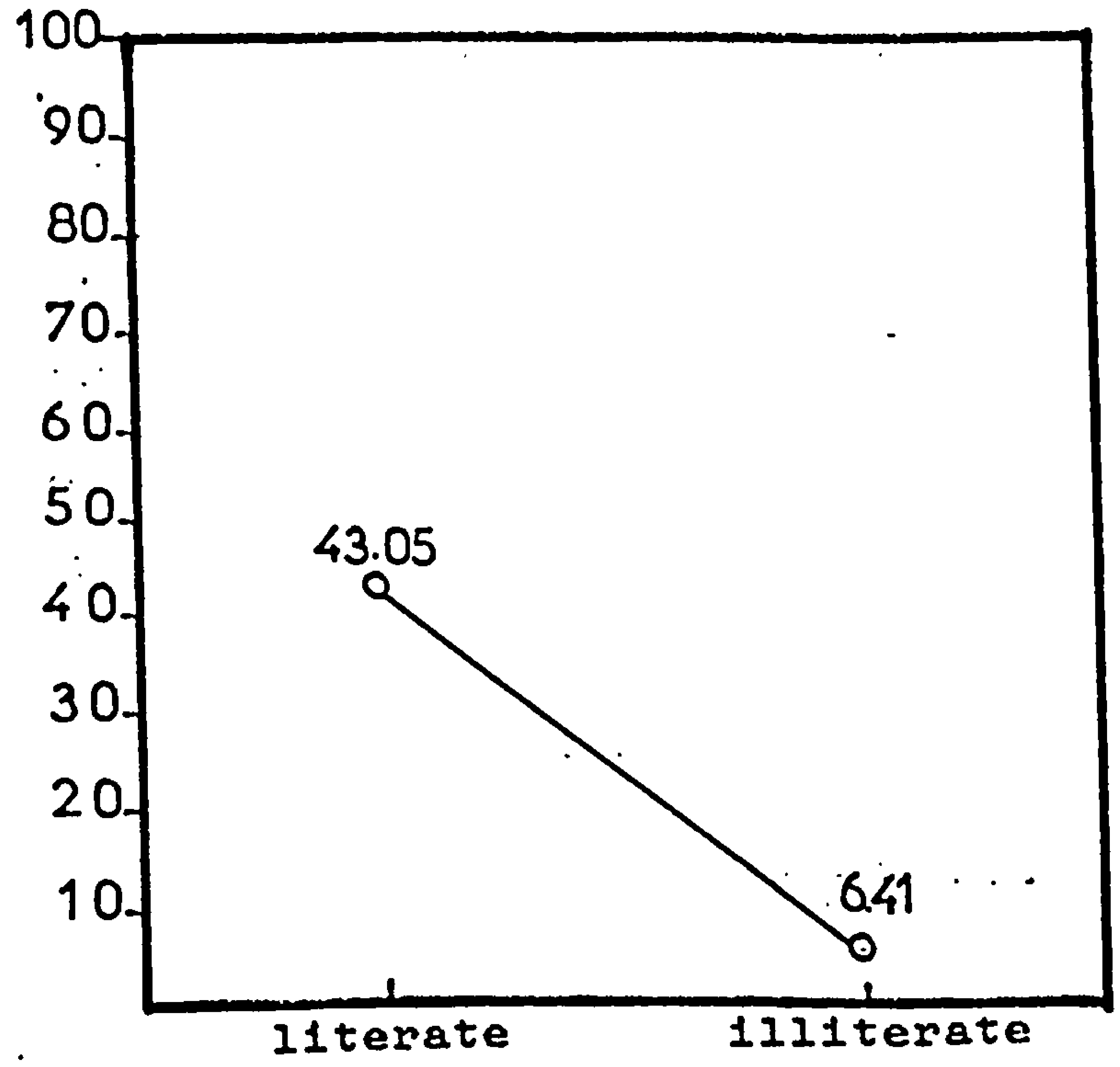
		LITERACY			
		Literate		Illiterate	
AGE	Child	34.06	(34.14)	1.43	(4.22)
	Adult	52.05	(32.35)	11.56	(21.65)

EXPERIMENT 7 - Table 6.7.6: Mean percentage of correct responses as a function of age and literacy. Standard deviations are in parentheses.

As Figures 6.7.E and 6.7.F indicate, both Age, (F_1 (1,91) = 6.55,



Experiment 7 - Fig. 6.7.E: Mean percentage correct responses as a function of age (Production task, Consonant condition)



Experiment 7 - Fig. 6.7.F: Mean percentage correct responses as a function of literacy (Production task, Consonant condition)

$p < .001$; F_2 $(1,28) = 40.68, p < .001$) and Literacy (F_1 $(1,91) = 44.29$, $p < .001$; F_2 $(1,28) = 149.81, p < .001$) effects were reliable with the latter the stronger. No Age x Literacy interaction was recorded, although there was an Age x Group interaction which was reliable only by materials.

It is clear from the data that the pattern of results from this task is not markedly different from that in the REC task. It is equally clear, however, that overall performance is very much worse here than in the REC task. The fall off in scores for all Ss was rather substantial (Compare Tables 6.7.6 and 6.7.1). The difficulty of, the present task, however, is less marked in the case of the literates ($\bar{X}$ = 43.05%) than in the case of the illiterates ($\bar{X}$ = 6.41%) who scored at floor level. An inspection of the distribution of scores indicates that 14 illiterate adults (or 77%) and 30 illiterate children (or 93.75%) who participated in this task failed to score. In contrast, only nine literate children (or 26.47%) and one literate adult failed to score. It will be remembered that this task employed the same stimuli as in the REC task.

2.2 Vowel Condition

Means for the vowel condition in the PRO task are displayed in Table 6.7.7.

		LITERACY	
		Literate	Illiterate
AGE	Child	23.05	00.00
	Adult	34.26	00.00

EXPERIMENT 7 - Table 6.7.7: Mean percentage of correct responses as a function of Age and Literacy.

There is no need for any further general statistical analyses to be performed for the major point these findings make is obvious. While overall performance was not high in these tasks, the effect was particularly marked in the illiterates who performed very much worse than the literates.

D. Summary

In summary, the data from the REC and PRO tasks for both consonant and vowel conditions indicate that:

(i) while both age and literacy factors were significant, the latter was more so (compare Tables 6.7.3 and 6.7.5). Both tasks have unequivocally distinguished literates and illiterates. However, among the literates, the adults performed better than the children. This result was further illuminated by correlation tests performed on the literate child data. They indicated that performance was dependent on the degree of literacy, with second graders performing significantly better than first graders;

(ii) irrespective of age, literacy or type of target segment (ie whether consonant or vowel), the PRO task was by far more difficult than the REC task. Scrambling segments in a word was more difficult than restoring their normal sequence. It will be recalled that both tasks employed the same stimuli (see Design) and that in the PRO task, Ss could permute segments into any order they chose;

(iii) contrary to expectations, neither the length of the stimuli, nor the different orders in the constitutive consonants of the test items were found to have an effect on the identification of the target words. Ss were no more able to identify the target word when the input word was C2 C1 than when it was C2 C1 C3 or C3 C2 C1. Nor were they more able to identify biconsonantal than triconsonantal words;

(iv) in each one of the two tasks, performance was better on consonants than vowels, thus confirming some observational evidence from other speech behaviour (eg speech errors, punning and aphasic speech) that vowels are more resistant to 'migration' to other locations than consonants. But more importantly, this finding emphasizes the awareness of the role of vocalism (or vowel melody) in forming the canonical pattern of a word in Semitic (see our discussion of Experiment 4);

(v) as in Experiment 3 (Final Syllable Indentification), Experiment 4 (Syllable Resequencing) and Experiment 6 (Final Segment identifaction), knowledge of orthography seems to help the literate Ss stabilize and organise their phonological knowledge. In particular, their mental representation of those items which do not retain the stem vocalism of the target word (eg Vowel condition in the REC task) tends to proceed with enhanced use of the orthographic code. This strategy, however, was not always successful in the PRO task.

VI General Summary and Conclusion

The original intent of this chapter was to determine the ability of literate and illiterate children and adults to deploy their metalinguistic knowledge by deliberately focusing on and manipulating speech segments.

In the three experiments reported on above, it has been consistently found that there is a strong support for the claim that awareness of speech segments is affected by literacy. The two literacy groups, it is demonstrated, differ dramatically. On the other hand, taken together the experiments appear to agree in failing to provide support for the cognitive maturational view despite the fact that the experiments were specifically designed to optimize the likelihood of observing pure relationship between maturation and segment awareness. To be sure, the effect of age does appear to be statistically significant, and overall, adults do perform better than children. However, the extent to which age plays a role appears to be quite modest. On the whole, the age factor appears to be important either because of the illiterate children's poor performance which depressed the overall mean for the child Ss considerably (eg Experiment 6) or because of the literate adults' superior performance which increases the grand mean for the adult Ss (eg Experiment 7); otherwise, the literate children's performance is consistently significantly better than both illiterate groups.

These results are further borne out by correlation tests on the child data which indicate that, of the two variables involved, literacy is the stronger predictor of segment awareness. The impact of just one year of schooling is particularly notable.

The results also demonstrate that overall, response adequacy appears to be controlled by certain linguistic variables that were manipulated in the test materials. Firstly, Ss seem to be more impaired in becoming aware of certain segments than others. Thus, they appear to be more aware of fricatives than plosives or sonorants (Experiment 5), and more aware of consonants than vowels (Experiments 6 and 7). Secondly, decisions on segments do not appear to be made independently of the adjacent context. Ss seem to respond differently to stimuli sharing the same target segment but having different syllable structure. Thus, their performance is significantly better when the target segment occcurs as the first element of a cluster than when it is a singleton (Experiment 5). Thirdly, among the literates, awareness of speech segments seems to rest upon the conventions of the writing system. Thus, knowledge of the orthographic structure of the language appears to exert extensive influence on their representation of speech (Experiments 6 and 7, in particular).

Taken together, these experiments demonstrate that awareness of the speech segment does not arise spontaneously as a result of maturational change. Segments seem to be available only to those who have mastered the grapheme-phoneme correspondence (ie the literates).

Thus, although speech segments may be shown to be psychologically (ie behaviourally) real in language processing, they are not necessarily available to conscious awareness. On this view, they may not be basic units, like, for example, syllables. In fact there is reason to believe that their level of conscious reality may be derived from syllables but not vice-versa. The finding that Ss respond differently to stimuli which share the same target segment but which have different syllabic structure (Experiments 5 and 6) is an indication that the syllable serves as a kind of framework for segment location. Segments appear to be dependent on the local context which is constituted by the syllable. In that sense, they can be seen as segmental properties of syllables, not discrete units.

That the literate Ss are able to attend to and manipulate speech segments may be attributable to some perceptual 'set' that they have acquired in the process of becoming literate. Thus, the perception that they impose on the speech signal to extract sound segments appears to be based on their knowledge of an alphabetic writing system and, in general, literate culture indoctrination which reinforces this practice. The illiterates, on the other hand, may possess a sophisticated language consciousness, but it is not necessarily focused on those aspects of the spoken language upon which the learning of a written language will depend.

In this connection, an interesting question remains unanswered. It was raised earlier in the chapter (see Introduction) and concerns the relationship between awareness of segments and the origin of the alphabetic writing system. The question can be framed thusly: If segments are not particularly obvious to those who have not mastered the grapheme-phoneme correspondence and if the alphabetic system is to be seen as a result of our metalinguistic thinking, how, then, can we account for the emergence of alphabetic writing systems themselves? Indeed, the existence of the supposedly superior alphabetic writing system is usually invoked in support of the awareness of the segment. We shall argue below that this observation may not be well-founded.

First, examination of the independently-created writing scripts reveals that, unlike syllabaries which appeared reccurently by independent invention, and in different parts of the world (Gelb, 1963), the alphabetic method of writing was derived directly from the pre-existing syllabary, and, it is thought, was invented only once (Gelb, 1963; Gleitman et al, 1977). This type of historical evidence does undercut the notion that there is something intuitively correct about analysing speech in terms of sound segments.

Second, the "discovery" of vowels, and hence, the invention of the alphabet can be viewed as no more than a historical accident. But to give such claims any plausibility, it is necessary to consider facts about the history and conceptual nature of the alphabetic principle. In the discussion that follows, we shall draw on works by Gelb (1963), Olson (1975), Gleitman et al (1977), Sampson (1985) and Campagna (1985).

Gelb differentiates four main stages in the evolution of writing from the earliest stages to the full alphabet. Relevant to our discussion are the last two stages, namely, the development of syllabaries and the invention of the alphabet. A true syllabary, if conceptually consistent, has a separate sign wherever there is either a different consonant within the syllable (eg a sign for 'ta' and another sign for 'sa'), or a different vowel (eg a sign for 'ta' and a sign for 'te'). An important step for the subsequent development of writing, was the use of a single sign to represent all syllables sharing the same consonant, even though the vowel differed. The West Semitic syllabaries used a single sign for a monosyllable ending with a vowel with the difference that the vowel was not represented. For example, the Hebrew character <Beth> would represent indifferently, [be], [bi], [bu], [bo]. It should be pointed out that since the signs were taken to represent syllables and not consonants, there was no need for signs to express vowels. Although Gelb (1963) does not make a special point of it, it should be emphasised that this principle of restricting signs to syllables having one consonant value appears to be the basic alphabetic value (See Olson, 1975). Furthermore, and as already mentioned earlier in our discussion of the principle of acrophony in the Semitic alphabet (see Experiment 6), in Semitic, the consonant of the name of the syllable (eg <Beth>) comes to be used as the sound value (eg B) that sign takes in the script.

What is important to note here is that the move toward the idea of phonemes (letter sounds) did not emerge self-consciously as an analytic notion that was then readily generalised. On the contrary, it appears that the users of early syllabic scripts were unclear as to whether the symbols used represented syllables or just the consonants of those syllables (Gleitman et al, 1977, p 18).

Given that, in Semitic, consonants play an important role in distinguishing the root forms (see previous discussions under Experiments 6 and 7), and given the limited role of vowels as distinctive elements, the idea of a vowel within a syllable seems not to have been recognised explicitly.

However, there are real disadvantages even for a Semitic language if vowels are completely ignored in writing. Indeed, the script (ie consonant-syllabic representation) frequently resulted in ambiguities of pronunciation, particularly in cases of writing words that could not be retrieved from context. In the main, it was this problem of ambiguity and not any conscious insight that led to the evolution of syllabaries into an alphabet.

To solve the problem of ambiguity, Semitic writing systems attempted to differentiate the vowel sounds by appending phonetic indicators (or vocalic phonetic complements (Gleitman et al, p 19)) [25]. These phonetic indicators (also called Matres lectionis (or Mothers of Reading)) were marks appended to the consonant-syllabic symbol as an aid to pronunciation of the ambiguous syllable. Again, this was not an explicit writing of vowel letters, although the writing looks essentially alphabetic.

The final step in the invention of the alphabet, taken only once in history and at that time by the Greeks, was the emergence of a full alphabet. But was this 'invention' from a transitional consonant-syllabic script really an analytic step (ie a conscious insight)? According to Gleitman and Rozin, it is better characterized as a "quasi-artistic development and extension" (1977, p 20). To support this view, a reconstruction of the way the Greeks came to invent symbols for vowel letters from the syllabary is in order.

Thus, by simply using consistently the Matres lectionis (and following the principle of reduction), the Greeks were soon able to reach the conclusion that the phonetic indicators were not syllables but rather vowels; consequently, the sign that preceded the sign representing phonetic indicators must not be a syllable either, but rather a consonant. Because of a limitation on the Greek phonological resources, the Greeks simply misheard the names of the Phoenician signs for syllables beginning with laryngal consonants [26].

Thus, their failure to perceive the initial consonantal sound, led them to assume that certain words (here the words of Phoenician laryngal-syllable names) began with a vowel, a lucky misapprehension that led to the vowel-letter concept. Since, as we remarked earlier, the initial sound of a syllable was taken as the sound value in the Semitic script, the vowels as well as the consonants could now be symbolized directly within CV syllables.

The systematic mishearing between two linguistic communities appears especially plausible in view of the fact that phonemes vary somewhat from language to language, and even from dialect to dialect. Speakers of one dialect find it difficult to hear distinctions that are readily made in another. That is, what is perceived depends not only on the physical constitution of the signal, but also on the basis of the listener's knowledge of the language as well as a host of extragrammatical factors (see Chomsky and Halle, 1968).

As observed earlier, the alphabet was never reinvented in a separate cultural development. It spread across the ancient world by direct borrowing and adaptation. The fuzziness of the inferential line from syllabary to alphabet may explain why it was invented only once.

It will be seen from the above discussion that the emergence of the alphabet was really no more than a simple historical accident and not the result of conscious awareness of speech segments. Sampson (1985) expresses this fact in his own way when he says "If Mycenaen civilization had not collapsed in the -13c, and if Greece had been spared the several-centuries-long Dark Age which then ensued, perhaps the Greeks would have had little use for the Semitic alphabet when they eventually encountered it, I might now be writing this book, and you reading it, in a syllabic script derived from Linear B. The idea of an alphabetic script of just a couple of dozen graphs could have been merely a curiosity confined to areas of the Middle East less influenced than Western Europe by Greek culture" (p 76).

While we realise that any reference to the unknown fountainhead of alphabetic writing is fraught with difficulties, it appears that the underlying principle of alphabetic writing was not the provision of a single sign for a single sound, but rather the reduction of the consonantal biphone of speech to the consonantal monophone of writing.

Closely related to the issue of the emergence of the alphabet and awareness of speech segments is the development of the phonemic theory. Thus, the case can be made (and indeed has been made) that the development of the phoneme theory has been influenced by the segmentation underlying different writing systems. We observed earlier, when we discussed the impact of orthography on the identification of segments (see Experiments 6 and 7), that not only does writing (in large measure) reflect the nature of the linguistic structure it serves to record, but writing itself makes accessible certain aspects of language that are otherwise beyond the grasp of illiterate speakers. It is probable that the alphabetic writing system has had considerable influence on the direction of professional linguistic analysis - particularly in the realm of phonology. A case in point is precisely the development of the phoneme concept and the theoretical apparatus based on it.

Thus, while the first comprehensive phonemic theory was made explicit by Baudouin de Courtenay around the beginning of this century, other scholars, one of whom is Sweet, also contributed greatly to the development of the phoneme concept. Though he did not use the term 'phoneme', Sweet independently arrived at a similar notion (he used the term 'broad romic') at approximately the same time as de Courtenay (see

Bugarski, 1970; Robins, 1979). What is important is that this concept emerged as a result of struggling with problems of orthography and transcription. The primary aim of men like Sweet, Ellis, and Bell was to determine the relationship between spelling and pronunciation (see Robins, 1979). As Robins notes, "the phoneme concept [...] originated in the search of broad transcription" (1979, p 206).

If it is clear that the phoneme concept underlies alphabetic writing systems, it should be equally clear that the notion became obvious only through analysing alphabets and struggling with problems they posed. On these grounds, the phoneme principle is most probably historically dependent on the existence of alphabetic writing. Furthermore, the use of alphabetic writing in phonological transcription, may also have a significant impact on phonological theories.

To conclude, while linguistic awareness may have been the psycholinguistic foundation for the creative thinking that led to the invention of writing (perhaps one of the first metalinguistic activities of mankind) which appeared recurrently by independent invention and in separate cultural developments, the discovery of the segment and hence the invention of the alphabetic script was not the result of any conscious insight. The failure of present-day modern illiterate man to attend to the segment in metalinguistic tasks, such as the ones reported on in this chapter, seems to mirror a cultural history seen in the evolution of scripts.

FOOTNOTES

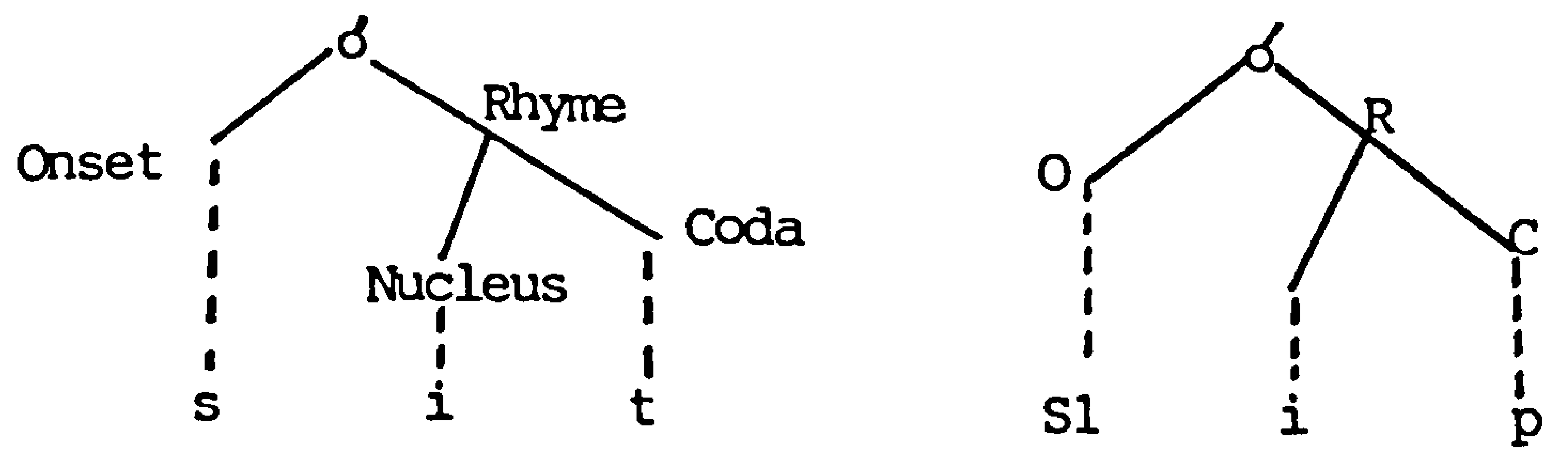
1. Although linguists differentiate between phones and phonemes, psycholinguists often treat the two terms synonymously. In this chapter the terms phoneme, segment and sound will be used interchangeably. This does not, of course, imply that there are no differences or that the differences are unimportant, but simply to indicate that a basis for choosing among them is lacking and awaits clarification. Furthermore, we leave open the question of how abstract phonemes are.

2. For example, the rule of Plural-formation for English is most efficiently stated by postulating the existence of two natural classes of segments, namely, sibilants and voiceless consonants. To state such a rule in terms of unsegmented syllables would be a great deal more complex since all the syllables of each kind would have to be listed.

3. Shane (1971) notes that "so long as generativists do not generate a narrow phonetic representation, their rules will generate explicitly a broad phonetic representation, which, implicitly is a representation of surface contrasts. It can be no more coincidence, then, that the output of a generative phonology is so often almost amazingly identical to a classical phonemic representation. This similarity ought to be disconcerting to generativists, since, if anything, it corroborates a phonemic type representation in spite of claims to the contrary" (1971, p 20).

4. Schvachkin's article was first published in 1948.

5. Theories of syllable structure (eg Kiparsky, 1980; Halle and Vergnaud, 1980; Mackay, 1972; Cairns and Feinstein, 1982) postulate that the syllable branches binarily into an onset to the left and a rhyme to the right which in turn branches into the peak or nucleus and the coda or margin. Grossly simplified, configurations for 'sit' and 'slip' are as follows:



The onset, which is optional is the initial consonant or consonant cluster. The rhyme is the remainder of the syllable. The peak, which is obligatory, is the vowel nucleus of the syllable. The coda, which is optional, is the following consonant or consonant cluster.

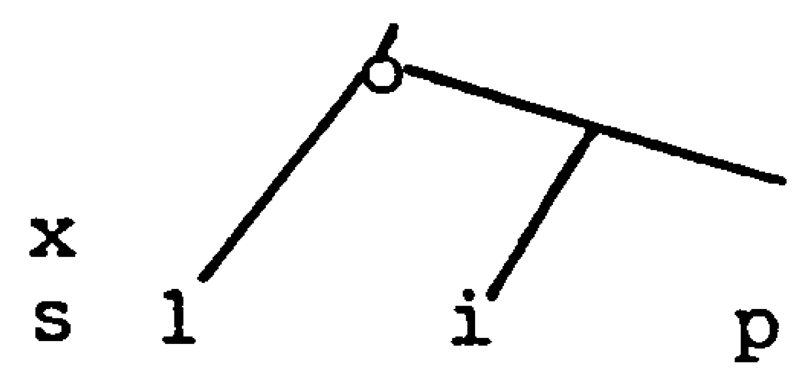
6. By cohesive, I mean the degree to which the sequence tends to 'stick' together in speech errors or experimental tasks where Ss are requested to identify the initial segment (see below).

7. A blend occurs when portions of two free morphemes, words or phrases are combined on a single form (eg producing 'symblem' when 'symbol' and 'emblem' are intended). In other words, a blend involves two words in paradigmatic relation to each other.

8. Two items comprising C + ə (ie Consonant + Schwa) were grouped.

9. We note here that since a segment cannot, of course, be pronounced by itself, Ss were required to sound out the consonants by coarticulating them with a neutral short vowel [ə]. Thus, [kə] was aceepted for inital /k/ in /kura/.

10. In this framework, a word such as 'slip' would have the following representation:



11. There are some problems in interpreting what is happening in these experiments. In the Wood and Day experiment, for example, faster reaction times to vowels might be attributable to the fact that a vowel can also have the status of a syllable. In that sense, the experiment is comparing syllables to consonants. Likewise, in the Savin and Bever experiment, there may be a position effect. Reactions to initial position may be faster than reactions to other positions irrespective of the unit involved.

12. It is important to note here that orthography tends to be more complex for consonants in word-final position than for those in initial position since it is generally in the final position that morphophonemic alternation occurs (eg sign- signature).

13. Except for vowel variations, the two Standard Arabic words /kita:b/ and /qird/ are the same as /ktab/ and /qərd/ in the colloquial variety.

14. It should be pointed out here that since some consonant segments cannot, of course, be pronounced by themselves, Ss were required to sound out the final consonants by carticulating them with a neutral short vowel [ə]. Thus [də] was accepted for final [d] in /bərd/.

15. There were originally 36 stimuli (18 in each set), half of which contained vowels as final segments. Since, however, vowels were excluded in the reanalysis of the data, we were left with a total of 18 stimuli.

16. The terminal [n] in the words /sabun/ and /ʔinsan/ is expressed orthographically by a consonant-grapheme, the letter <n>. The

same phonetic sound in the word /ʃukran/ is expressed by a double diacritic <—> appended to a carrier (here the letter <aleph>).

17. Some literate children's reactions to E's suggestion that the terminal sound in /kitabun/ is [n] was that there was no letter <n> but <bun>, (the final root consonant /b/ onto which are appended the double diacritical mark is read <bun>).

18. One way of characterizing these facts as suggested by, for example, McCarthy (1979), is by postulating discontinuous (non-concatenated) morphemes. McCarthy demonstrated that these morphemes are presented each on its own austosegmental tier and are linked to units of the core which is a sequence of C and V slots as indicated below:

```
d     r     s            d     r     s
|     |     |            |     |     |
C  V  C  V  C            C  V  C  V  C
                            |     |
      a                     u     i

  /daras(a)/               /duris(a)/
```

19. It is thought likely that the inventors of the Semitic script took the 'acrophonic' principle (ie representing sounds by pictures of things whose names began with the sound in question) from the Egyptians. However, the Semitic alphabet itself was clearly an independent creation (see Diringer, 1963; Sampson, 1985).

20. According to this model, lexical memory includes a set of evidence-collecting devices, the logogens. These devices serve as an interface between the sensory system and the cognitive lexical memory. A string of letters that is physically similar to a word may activate its logogen. There is a positive relationship between the amount of similarity and the level of the logogen's excitation. Whenever a logogen is excited beyond its threshold, access to the word in the lexicon is achieved and a 'yes' response is generated. If, however, no logogen is excited beyond its threshold within a given time limit, a 'no' response is generated. This time limit may be dynamically adjusted up or down during processing by the general level of excitation of the whole logogen system.

21. An experiment by Bertelson (1972) and Bertelson et al (1975) may help illustrate this last point. The experiment is based on Fodor and Bever's (1965) click experiment. In this type of speech perception experiment, a subject hears a click while listening to a recorded sentence and is asked to estimate the part of the sentence with which the click was simultaneously presented. Fodor and Bever found - quite by accident - that when the click location task was administered dichotically, the click was judged as coming

earlier when it was delivered to the left ear and the speech to the right ear than with the opposite arrangement. Bertelson and colleagues replicated this finding. They conjectured that from the Ss' perspective, the click is in fact perceived to the left of the sentence, which is presumably transformed in a left-to-right array.

Hence, when Ss are asked to mark the location of the click on the response sheet, they tend to displace the mark towards the beginning of a sentence. Bertelson and colleagues further speculated that the opposite result should be obtained for Ss whose language is written from right-to-left--- in this case Hebrew. Indeed they found that literate Hebrew speakers, listening to Hebrew sentences in a similar click experiment, preposed the click when the speech was in the left ear and the click in the right ear more than in the opposite arrangement. Hence, the direction of the effect is inverted when a language that is written from right-to-left, namely, Hebrew, is used in the test.

Two conclusions can be drawn from the above experiments. Firstly, writing seems to be immanent in natural speech perception. Concurrently and as a consequence scriptural differences between two languages appear to be reflected in the way the two languages are processed.

22. The situation is more complex, but not in ways that affect the present discussion. For example, roots are classified into different types according to quantity as well as quality of the consonants which comprise these roots. Quantitatively, the number of consonants of a root determine its type (eg triliteral, quadriliteral). Qualitatively, roots can be classified into three types. Cutting through some complications, these are: strong, weak and doubled.

    (i) strong roots are those which consist entirely of different consonants

    (ii) weak roots are those which have a vowel element which often alternates with one of the glides (this type is known as 'hollow root'.

    (iii) doubled roots are characterized by identical consonants (C CiCi) in second and third position

23. We note here that vowel quality is different. This is because it is subject to regular phonological effects under the influence of neighbouring consonants, so it varies correspondingly.

24. Only 107 Ss participated in this experiment.

25. In a logographic writing system (eg Chinese) a phonetic complement is a sign appended to the logogram (word) and is unpronounced. It gives a clue to the pronunciation of the logogram. For example, if English used this system, the logogram for 'book' would be

accompanied by an additional sign interpretable as "... sounds like 'cook'".

26. Thus (aleph) standing for /ʔ(a) / in Phoenician became the Greek letter A (alpha) standing for the vowel phonome /a/.

CHAPTER SIX

I Introduction

The original intent of this study was to assess the ability of native speakers to deploy their metalinguistic knowledge by deliberately focusing on and manipulating language. We characterised metalinguistic knowledge as a construct which refers to what a native speaker knows about his language activities and what he is able to do about them. The present work considers that this area of enquiry which was once viewed as peripheral, constitutes an important dimension of the task of knowing one's language. The diversity of research and the divergence of opinion regarding the nature of metalinguistic knowledge and its relation to other cognitive phenomena reflects the difficulty of researching this area which stradddles both psychology and linguistics.

Our primary concern in this work has been to elucidate the processes underlying certain aspects of metalinguistic awareness and to trace their relationship - if any - to advances in maturation and acquisition of literacy. The guiding principle for the study has been to determine how much of what has been considered normal cognitive development is in fact an age-bound developmental phenomenon, or to what extent it reflects the result of experiences associated with the degree and extent of literacy.

Another aim of the study has been to demonstrate that much work in the past has been rather narrow and misleading, tending to focus in particular on metalinguistic awareness as a psychological process, and often ignoring the linguistic processes.

The purpose of this chapter is to review the major conclusions that have been drawn from the arguments and evidence presented and then discuss their implications for certain aspects of linguistic and psycholinguistic research. Some limitations of the study will also be examined.

II Some Conclusions

The first and the most important conclusion is that various claims made in past research that there is an increase with age in the mechanism of metalinguistic awareness introduces seemingly inescapable anomalies unless interpreted in the light of the literacy factor. Put another way, the maturational view is valid - if at all - only if it is also assumed that another factor, namely, literacy is a crucial ingredient of this mechanism.

Thus, it has been consistently found that there is strong support for the claim that metalinguistic abilities are affected by literacy. The two literacy groups, it has been demonstrated, differ dramatically. On the whole, pervasive and strong effects of literacy were found whether the effects were assessed by comparing literate and illiterate children matched for age, or by comparing literate children with illiterate adults. For the literate group there was also clear influence of knowledge of the written language. In particular, knowledge of the orthographic structure of the language appears to exert extensive influence on their representation of speech. Considering the complexities that emerged in other studies, it is remarkable that the effects of literacy were as consistent and clear as they proved to be.

On the other hand, despite the fact that they were specifically designed to optimize the likelihood of observing clearly the relationship between advances in maturation and language awareness, most of the present experiments appear to agree in failing to provide support for the cognitive maturational view. To be sure, the effect of age does appear to be statistically significant, and overall, adults do perform better than children.

That, overall, age was also found to be statistically significant in some of the experiments is hardly surprising. There are at least two reasons for this. First, and as already stated in Chapter 1, no one would deny that the course of maturation plays some role in the development of metalinguistic knowledge. Being a cognitive achievement, metalinguistic knowledge must require the attainment of some level of intellectual maturity. There is an age below which young illiterate children have considerable difficulty performing certain tasks (see Chapter 2).

Secondly, and more importantly, the statistical significance yielded by the various experiments is an <u>overall</u> result which <u>masks</u> an important finding. Thus, on the whole, the age factor appears to be important either because of the illiterate children's poor performance, which depresses overall means for the child sample considerably, or because of the literate adults' superior performance which tends to increase grand means for the adults Ss. That literate children performed consistently better than illiterate adults is enough proof of this. As Barton and Hamilton (1980) note, "literacy seems to fill in what they don't have".

These results were further borne out by correlation tests on the child data which indicated that, of the two variables of age and literacy, the latter is the stronger predictor of metalinguistic knowledge, however much the two variables seem to be confounded in the real world. Chronological age had little influence on performance. This finding is especially interesting in view of the proposal (eg Ryan, 1980; Hakes, 1980) that metalinguistic awareness emerges during middle childhood (4 to 8 years). We found little indication that changes in performance described as occurring during this age span are the result of the simple intellectual maturation. Rather, most of the changes appeared to be related specifically to strong literacy effects. The impact of just one year of schooling is particularly notable. We discuss this last point further below. It suffices to note here that schooling in general and literacy in particular seem to add and promote an alternative psychologically compelling code. It may be that they provide new and more powerful code and notation systems which help organise information efficiently.

In sum, while undoubtedly some minimal cognitive level is necessary, it now appears that the extent to which age plays a role in metalinguistic abilities is quite modest; certainly more limited than proponents of the maturational view are prepared to admit. Past studies which support the view that metalinguistic awareness is related to maturational advances in the child now appear to rest on inadequate methodology. By the same token, our findings have demonstrated that the assumption that all adults are capable of such metalinguistic reflection, as is held among some researchers, is inaccurate. Incorporating the effects of literacy into a model of metalinguistic awareness permits if not a resolution, at least a clarification of the cause-effect question that can be found in the literature, namely, is the homogeneity in the results of past research attributable to maturation or to the fact that Ss were literate?

Another important conclusion is that metalinguistic awareness may not, after all, be a unidimensional or a unitary phenomenon where literacy pervades all abilities. We have found evidence for the effects of literacy on metalinguistic abilities. However, it would not be accurate to claim that this holds for all metalinguistic abilities. This is particularly true of the ability to identify words and initial syllables: the results yielded by Experiment 2 indicate that the manipulation of initial syllables is resistant to maturational change and relatively unaffected by literacy. These findings were shown to be compatible with the conclusions drawn in some related psycholinguistic studies displaying the role of the initial syllable in various speech behaviours (see Chapter 4).

A conclusion to be drawn from this is that while literacy was found to increase metalinguistic abilities as tapped by the experiments reported on in the present study, illiteracy does not necessarily indicate a total absence of these abilities. The results imply that the inability demonstrated by illiterates is task-specific. It may be due to their inability to manipulate abstract speech representations and not to a more general inability to reflect upon the structure of language itself. Our findings suggest that there are levels of phonological awareness. It may well be that illiterate speakers possess a sophisticated language consciousness, but it is not necessarily focused on those aspects of language on which their tacit linguistic processing does not depend. In this context, it is worth speculating that failure of present-day illiterate man to attend consciously to speech segments seems to mirror a cultural history seen in the evolution of scripts.

Earlier in this chapter, we have observed that one immediate impact of literacy was particularly notable. The effect of literacy seems to occur after only a few months of schooling (literate children had had a minimum of 8 to 9 months and a maximum of two years). There was generally a total absence of correlation between Task and Grade (Grade 1 v Grade 2) when literate children were compared. This is a substantive aspect of the result since it indicates the large, and more importantly, the immediate effect of literacy on metalinguistic awareness. The fact that literate children outperformed illiterate adults is even more revealing.

Drawing from the above observations, it may be interesting, indeed useful, to suggest that a distinction ought to be made between literacy and schooling. In other words, it would be interesting to isolate the effects of being literate separately from the effects of attending school or being educated. A limitation of the present work has been to employ school-literates only. It rests with future research to investigate these factors separately. But can literacy and schooling be separable?

One study has found a situation in which they are. Scribner and Cole (1981) investigated the consequences of school literacy and non-school literacy among the Vai people of Liberia for whom schooling and the acquisition of literacy are separate activities. Thus, according to Scribner and Cole, between 20% and 25% of Vai men could read and write using their own script, which was invented approximately 150 years ago and transmitted from one generation to another without schooling or professional teachers. The authors point out that for some 'cognitive skills' (eg sorting and reasoning tasks) which they investigated, script-associated skills were more localised (ie task specific) than those developed by schooling, which contributed more to performance on most tasks. Their conclusion is that script did not, in their own words "act as a surrogate" for schooling by which they mean that schooling rather than literacy is the significant cause of any major changes in "cognitive skills".

Interestingly, Scribner and Cole also employed some tasks to explore what they call 'metalinguistic skills' including nominal realism, the identification of name and object, and the 'nature of grammatical rules', to reason from evidence provided by a syllogism and to define 'words'. It is important to note that these tasks are not comparable to ours [1]. The authors found that literacy without schooling was "associated with small increments in performance for some of the tasks" but not for all the tasks. Interesting as this may be, clearly more research is needed for a full appreciation of the possible differences - if any - between school-literacy and non-school literacy and their impact on metalinguistic knowedge. For the present, the issue is open to debate. However, with Smith (1985), it should be pointed out that non-school literacy (informal teaching in Smith's terms) may concentrate on the purpose rather than on the process. This may apply to the Vai literacy discussed above. School literacy (formal instruction) is self-conscious, particulate, and metalinguistic. It uses language as an object of reflection and analysis. It does not, by and large, involve participation in a purposeful process.

III Some Implications

Given the above conclusions and given the basic assumption that the goal of a linguistic theory is to characterize insightfully the actual linguistic knowledge that underlies both the 'basic linguistic capacities' (Bever, 1970) and metalinguistic abilities, it is clear that our findings have important implications for linguistic theorizing. In what follows, we discuss some of these. Specifically, we focus on the implications of our findings for the prevailing view that writing is merely a manifestation of speech which is the sole source of data for linguistic research and the priviliged mental code for language.

The position that speaking and comprehending speech are primary and reading/writing are secondary has it sources in the history of linguistics: many linguists have proclaimed in their writings that language is speech, and by implication that writing and other non-verbal modes of language expression are codification of speech. Written language is essentially assumed to be a graphic counterpart of speech, and in some ways a substitute for language. Thus, Sapir, Bloomfield, Hockett and Saussure excluded written language from their domain of study. This attitude is explicitly expressed in Saussure's (1964) own words: "Langage et écriture sont deux systèmes de signes distincts; l'unique raison d'être du second et de représenter le premier" (p 45).

In a similar fashion, Bloomfield (1933) views language as intrinsically parasitic on speech. "Writing is not language but merely a way of recording language by means of visible marks" (p 24) [2]. In his Let's Read, he states "writing and reading is merely a device for recording and playing back speech" (p 20). This conception is also shared by Block and Trager (1948) who state that a linguist is a "scientist whose subject matter is language, and his task is to analyse and classify the facts of speech, as he learns them uttered by native speakers or as he finds them recorded in writing" (p 8 - emphasis mine).

Likewise, within the framework of generative phonology, the relevance of the written variety as contributing to linguistic knowledge has been ignored. Written language is generally treated as outside the data that a phonologist would consider as a basis for his data. In Syntactic Structures (1957), Chomsky does define language as "spoken or written sentences". In Aspects (1965), however, Chomsky seems to have changed his mind when he uses "speaker-hearer". Speaker-hearer, whether ideal or not, does not entail reader-writer.

Although there is some evidence that the above views are no longer so strongly held, weaker versions of them are still very much in evidence. Indeed, the view persists that language is speech and speech is language among many linguistic theories which still rigidly restrict their goals to deal with one form and only one form of human language, namely, spoken language.

That oral data must be regarded as the basis for grammar formulation can hardly be disputed, but the notion that the spoken word alone constitutes the object of study leads to a failure to see the consequences of literacy on language behaviour. Our findings tend to dispute these assumptions and can be said to reveal that examination of the written mode offers valuable insights into the nature of language. The relationship between spoken and written language is not a matter to be taken lightly; rather it is central to a theory of literacy and to a theory of language in general.

Exceptions to the view that language is speech and speech only, although few are available. One such exception is Householder (1971) who argues for the primacy of writing over speech [3]. He points out that historically there are many more instances where orthographies have changed the pronunciation of words than the reverse. Language change operates in the direction of the orthography at least some of the time. Orthography may have a regularizing effect on speech [4]. Consequently, he contends, "there is no excuse for leaving orthography out of the grammar" (p 263). Likewise, a psycholinguist Braine (1974) also contends that

> "the role of orthography in the learning of phonological representation must be studied if we are to arrive at an adequate acquisition theory" [5].

Ferguson (1968) remarks that after the spread of literacy,

> "varieties of the spoken language can no longer be described *in vacuo*; they will interact with the written form to a greater or lesser degree and the linguistic analyst must note spelling pronunciation, lexical displacements, and grammatical fluctuations, which originate or are reinforced by written usage" (p 222-23).

Indeed, Vachek (1962), a foremost exponent of the view that speech and writing are both related to underlying language, characterizes the effects of the written language as "one of the external factors exerting their influence on the spoken system" [6]. If language change can be admitted as evidence for the psychological reality of phonological representations (see Kiparsky 1968), then the existence of spelling pronunciation must be counted as evidence that orthography is in fact psychologically real.

Recently, Bentur (1978) has argued that "certain systematic aspects of speakers' linguistic behaviour remain totally unexplained if oral data are taken as the sole basis for the formulation of grammar" (p 13). She contends that in order to account for these specific systematic aspects, the relevance of the written language must be acknowledged. Deriving her data from Modern Hebrew, Bentur has convincingly demonstrated that a satisfactory explanation for certain morphophonemic alternations can be provided only if the possible effects of the speakers' exposure to the modern orthography of the language are incorporated. Bentur has evidence that children learn these morphophonemic alternatations in Modern Hebrew when they learn the spelling.

According to the same author the orthographic factor is viewed "as external only because the domain of linguistics has been pre-defined as the spoken variety of language alone" (p 63). Put another way, what may be external evidence to the linguist, may not be so to the language-user. Linguists will do well not to underestimate the speaker's internalized knowledge, and, at least for some languages, they should regard orthorgraphy as having a much more central theoretical role than it is normally accorded. If written language is indeed used by native speakers as part of their knowledge of the language, it should be treated as an integral part of the linguistic system of speakers, and, be incorporated in a linguistic model.

Another area for which our findings have implications is that of derivational morphology which has been rather neglected within generative linguistics (see Jackendoff, 1975; Aronoff, 1976). In their claim that certain lexical items stand in a derivational paradigm, some linguists make the implicit prediction that native speakers perceive them as closely related, i.e. that they are regarded as sharing semantic and phonetic properties (see our discussion of Derwing's work in Chapter 5). This may not be the case for literate speakers who may regard orthographic similarity as another condition that must be met in order that relatedness be perceived. The role of spelling in shaping literate native speakers' perception of word relatedness cannot be ignored. Furthermore, as has been shown in the present study which has used diglossic Ss, familiarity with the written variety of the language provides speakers with new lexical information which might affect the structure of the already existing lexicon. As Bentur (1978) also suggests, there is no *a priori* reason for excluding the possibility of having different models to represent the systems of different speakers according to their various degrees of literacy (in this case familiarity with the standard form which, in fact, is the written form (eg Classical Arabic vs Moroccan Arabic)).

Apart from the above studies, more recently, Nathan (1979), Linell (1982), Deuchar (1984), Stubbs (1984), Coulmas (1983) [7], have also challenged the view that speech is the sole source of data for linguistic research and that writing is a representation of speech and have argued for more precise evaluations of the spoken and the written forms. In his *The Written Bias in Linguistics* (1982), Linell draws attention to a remarkable paradox (but only apparently a paradox as we demonstrate below) that exists in the linguistic trade. That is, the obvious contradiction between what modern linguists claim they do and what they actually do in practice. It is to this paradox that we now turn.

Despite the prevailing view that writing is merely a secondary manifestation and that speech is primary, and therefore the only interesting object of study, many linguists have, paradoxically, taken their models of language from their own experience of the written form. Thus, despite their insistence that they are working on speech, they have been, very often unwittingly, biased by what has been dubbed 'scriptism' (in constrast with 'phonocentrism'). Many linguists claim to be concerned with speech, whereas we know that they are working on written language, precisely <u>written sentences</u>. (Linguists are able to investigate sentences precisely because sentences can be written down). According to Olson (1977), Chomsky's approach is implicitly based on a notion that derives from written standard. Likewise, Stenning (1979) argues that TG presupposes a 'literate attitude'. Where spoken language is actually studied, it is approached with a conceptual apparatus which is often derived from experience of written language analysis (see Linell, 1982). According to Coulmas (1982), given such a situation "speech units are not only made <u>visible</u> by writing; rather, they are <u>created</u> by writing" (p 472 emphasis in text). The use of alphabetic writing as the metalanguage of phonology is likely to have a significant impact on our theories of phonological structures. For example, and as we demonstrated in Chapter 5, the phoneme concept became obvious only through analysing alphabets and struggling with problems they posed.

The above paradox can be easily resolved when we realise, with Street (1984), that it is precisely the theoretical assumptions that speech and writing were fulfilling the same functions that made it possible for linguists to employ one linguistic form as a model for the other.

To summarize this section, past studies which investigated the relationship between spoken and written language largely concerned themselves with exploring the impact of the former on the latter. This concern was based on the assumption that speech is primary and writing is merely a representation of it. Our findings imply that identification of speech as the sole source of data is not well motivated. Assumptions about the primacy of speech have precluded recognition of the possible impact of literacy in general and orthography in particular. What is needed is not only a more adequate analysis of spoken language, but also a general recognition of the importance of writing [8].

That oral data must be regarded as the basis for grammar formulation can hardly be disputed, but failure to recognize that writing exerts an impact on literate cultures leads to unwarranted conclusions. As Coulmas (1983) points out, certain speech acts can be carried out in writing only, or require some combination of oral and written execution. For example, a question such as "Can I have that in writing?" can only be asked sensibly in a literate society where it has a very particular meaning and communicative function. Many other uses of language depend on writing which seems to impinge on the communicative habits of literate cultures.

Although psycholinguists have been negligent in providing linguists with an adequate account of literacy effects in various language behaviours, it now appears that the prevailing view that speech is the priviliged mental code for language is not well founded and at best odd, for to say this is to say that our knowledge remains unaffected by the process of becoming literate. Writing appears to exert such tremendous influence on our mental representation of speech. That literacy may figure in the unconscious knowledge that speakers have about their language can no longer be easily dismissed. If it is clear that awareness of the spoken language can be mediated through written language, then we must incorporate an account of this literacy-derived knowledge in a non-trivial way.

In conclusion, we note that research on literacy to date has been undertaken by psychologists who have paid explicit attention to the relationship between spoken and written language by investigating the perceptual and cognitive faculties involved in writing, and by educationists who have attempted to assess the pedagogical implications of this research. On the other hand, linguists, whose aim is to characterize insightfully the native speaker's actual knowledge of the language, have as yet to reclaim literacy as a genuine object of their concern.

Further research into perceptual skills, cognition, and (meta)linguistic knowledge of the speaker-hearer/writer-reader can lead us to a better and more comprehensive understanding of man's unique achievement, literacy. By attempting to elucidate the processes underlying certain aspects of metalinguistic knowledge and to trace their relationship to advances in maturation and literacy, the present work is a modest contribution toward that long research programme.

FOOTNOTES

1. It is worth pointing out here that Scribner and Cole's research project started in 1974.

2. Bloomfield's (1933) Language is in fact subtitled: A Study of Speech (!)

3. In this context, Gelb (1963) and later Goody (1977) argue that writing and speech are not historically linked derivatively. Gelb states "In the beginning, pictures served as a visual expression of man's ideas in a form to a great extent independent of speech which expressed his ideas in an auditory form. The relationship between writing and speech in the early stages of writing was very loose, inasmuch as the writer's message did not correspond to exact forms of speech". According to Gelb, writing was not a result of trying to record speech, but as a means to represent adequately personal names to make record-keeping more accurate.

4. Some of the effects of the written mode on the development of the spoken system are:

   (i) retardation of change
   (ii) standardisation
   (iii) spelling pronunciation

   According to Olson (1975) for example, the orderliness of the writing system had a systematizing effect on the system of pronunciation itself. That is, the invention of writing not only recorded speech but also led to the regularisation of that speech (p 127).

5. Braine (1974) further notes that the issue is not that phonological analyses of 'abstractness' "fail to capture generalisations; rather, it is whether the native speakers make generalisations as the theory captures them".

6. Of the mainstream linguistic trends in this century, only the Prague School linguists who, because of their concern with style, maintained an uprejudiced interest in written language. Thus, they held that speech and writing are both related to underlying language, but are different styles of different systems for responding to the same stimuli.

7. Edited by Coulmas, a whole issue of the Journal of Pragmatics (1983) was recently devoted to the 'linguistic problems of literacy'. Similarly, another journal, Langue Francaise, devoted a whole issue (volume 59, 1983) to the same topic.

8. In a recent study on the connections betwen spoken and written language, Naucler (1983) reports findings based on normal and pathological written and spoken performance which she interprets as

indicating that:

(1) written language is not speech written down. This was suggested by the selectivity of the aphasic errors and confirmed by spelling errors made by skilled non-aphasic Ss. According to the author, these facts argue against the dependence model, that writing speech are connected at a concrete phonetic level and point to the independence model, that speech and writing are two parallel means of linguistic expression connected only at the semantic level.

(2) written language is not, however, totally independent of spoken language. This was supported by the similarities between slips of the tongue and slips of the pen. Thus, the independence model is rejected.

(3) spoken and written language were shown to be connected at an abstract phonological level in that not only slips of the tongue but also slips of the pen and aphasic written errors can be described on the basis of phonological features. The author concludes that an interdependence model is a more appropriate description of the relationship between spoken and written language.

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APPENDIX A

SET A

1. xuʒa xebʃatu (qemʃatu) qeTTa kbira
2. laTifa klat lħelwa kullha
3. darna qreb men darkum
4. ʃnu ʃriti men lħanut
5. mʃina lmeknas ʕla reʒlina
6. waHd lweld tlef ʕla darhum
7. tsalemt mʕa ħmed (saʕida) f- ssbaH
8. ma mʃa mʕaja ħtta weld
9. huwwa lli Drebni w-hreb
10. lli qra mezjan ɣadi nʒeħ
11. had lmedrasa zwina bezzaf
12. bɣit ktab bħal hada
13. kul sbaH kanʒi f-TTobis
14. saʕid kajlʕeb f-zzenqa
15. mʃina w-ʒina b-zzerba
16. Derbuni l-wezhi belkura
17. ʕemna w-lʕebna f-lebħar
18. ʕali naʕes w-ħmed kajlʕeb f-zzenqa

SET B

1. lkas herrsu lweld
2. mesTafa ʃra ktab fih tsawer zwinin
3. ktabna ħsen men ktabkum
4. fugaʃ xreʒti men lmedrasa
5. ħTTit lektab ʕla TTebla lekbira
6. ħmed sellem ʕla mesTafa
7. mʃit mʕa saħbi (saħebti) l-ssinima (l-ddar)
8. reʒʕu mʕa lʕeʃra
9. maʃi ʔana lli Drebt saʕid
10. waʃ nta lli kliti lħelwa
11. had lektab zwin bezzaf
12. ħeTT had lektab fuq TTebla
13. lbareħ tferreʒt f-ttilifizjun
14. feqna f-ssba bekri
15. ʃrit had lkura b-mjat derhem
16. qeTTeʕna tteffaħa b-lmus
17. saʕid w-faTima mʃaw l-merrakes
18. ʃrit ʒuʒ ktuba w-qlam ħmer

APPENDIX B

	SET A	SET B
Monosyllabic stimuli		
1.	bɣat	bqat
2.	mra	ʕTi
3.	ʒa	la
4.	ʕeDD	ʒerr
5.	zid	faq
6.	berd	qerd
Bisyllabic stimuli		
1.	kura	ʔaʒi
2.	raʃid	saʕid
3.	ħmama	dʒaʒa
4.	meʕza	begra
5.	sellum	feggus
6.	fekrun	qenfud
Trisyllabic stimuli		
1.	ʒelbana	meʃmaʃa
2.	teffaħa	dellaħa
3.	maTiʃa	limuna
4.	kaʝɣeslu	kaʝleʕbu
5.	ʔamina	ddinaha
6.	ʃrinaha	lwimina

A P P E N D I X C

SET A

RECOGNITION	PRODUCTION
1. midħa	Tobis
2. Tasem	limuna
3. rutsa	musiqa
4. sikur	keswa
5. Tafu	ferdi
6. rabeg	ʒelbana
7. raku	namusa
8. meʕʒa	Taksi
9. qaqu	duda
10. nabuSa	suʕad
11. ħatifa	saʕida
12. ʒadixa	ħuta
14. Danamu	zituna
15. radimu	faTima
16. nagama	ʔatay
17. maʕina	ʕali
18. ɟaTima	sinima

SET B

1. bisTo	ħamid
2. tayʔa	Sabuna
3. ʕadsu	magana
4. wakes	maTiɟa
5. taħu	kursi
6. dadu	begra
7. difer	quqa
8. liʕa	medrasa
9. siTak	munaDa
10. namuli	semTa
11. daʕisa	ʒameʕ
12. natuzi	xadiʒa
13. samuna	kura
14. naziku	naʕima
15. qasimu	mudira
16. nabaʒel	fatiħa
17. maTifa	sarut
18. manisi	fuTa

APPENDIX D

SET A

1.	bit	bga
2.	kura	keswa
3.	Tagijja	Triq
4.	fuTa	flus
5.	ɣaba	ɣsel
6.	xizzu	xruf
7.	zituna	zreq
8.	naqus	nmer
9.	limuna	lʕeb

SET B

1.	tur	tmanin
2.	quqa	qnijja
3.	ʕazi	......
4.	ħanut	ħmama
5.	ʕumar	ʕTa
6.	ʒib	ʒrana
7.	ʃaf	ʃemʕa
8.	maTiʃa	mʕelqa
9.	waxxa	wlad

APPENDIX E

SET A		SET B
1.	ferdi	ʔaʒi
2.	kura	fuTa
3.	xuxa	sebʕa
4.	limuna	zituna
5.	xizzu	seddu
6.	bibi	ʕali
7.	ʃwi	kursi
8.	qfez	ferruʒ
9.	ferx	ʃemʃ
10.	mus	sbeʕ
11.	ɣar	far
12.	serwal	klaw
13.	bab	ktab
14.	sedd	ʕeDD
15.	sebbaT	Triq
16.	fekrun	Sabun
17.	zitun	kamun
18.	kitabun	qirdun

APPENDIX F

SET A

PRODUCTION		RECOGNITION
1.	far	siɣ
2.	fTur	ɣba
3.	ʔaʒi	Tufa
4.	mudir	ʃarid
5.	meqla	Daqus
6.	malika	dumira
7.	sellum	reffuʒ
8.	fuʔad	qenza

SET B

1.	Hut	raf
2.	mʃa	Tfur
3.	xizzu	ʒaʔi
4.	Tobis	dumir
5.	keswa	qemla
6.	limuna	lamika
7.	ferran	lessum
8.	suʕad	duʔaf

A P P E N D I X   F

SET C

	PRODUCTION	RECOGNITION
1.	bit	tuħ
2.	flus	ʃma
3.	kura	zixxu
4.	naqus	boTis
5.	samir	sekwa
6.	makina	miluna
7.	dellaħ	reffan
8.	besla	duʕas

SET D

1.	ɣis	tib
2.	bɣa	lfus
3.	fuTa	ruka
4.	raʃid	qanus
5.	qaDus	masir
6.	mudira	kamina
7.	ferruʒ	leddaħ
8.	zenqa	lebsa <fn1>

<fn1> The presentation of this stimulus as 3-1-2 instead of 3-2-1 (lesba) was an error in the preparation of the materials that failed to be caught.